

1. Thomas A. Hulcher
DESCRIPTION
OF THE ADMIRABLE
TABLE OF LOGA-
RITHMES:

WITH
A DECLARATION OF
THE MOST PLENTIFVL, EASY,
and speedy vse thereof in both kindes
of Trigonometrie, as also in all
Mathematicall calculations.

INVENTED AND PVBLI-
SHED IN LATIN BY THAT
Honorable L. IOHN NEPAIR, Ba-
ron of Marchiston, and translated into
English by the late learned and
famous Mathematician
Edward Wright.

*With an Addition of an Instrumentall Table
to finde the part proportionall, inuented by
the Translator, and described in the end
of the Booke by HENRY BRIGES
Geometry-reader at Gresham-
house in London.*

All perused and approved by the Author, & pub-
lished since the death of the Translator.

LONDON,

Printed by NICHOLAS OKES.

1616

Thom. Panner.





TO THE RIGHT
HONOVABLE AND
RIGHT WORSHIPVLL
COMPANY OF MERCHANTS
of London trading to the East-
Indies, SAMVEL WRIGHT

*wisheth all prosperitie in this
life, and happinesse in the
life to come.*



Our fauours towards
my deceased Father,
and your employment
of him in businesse of
this nature, but chiefe-
ly your continuall im-
ployment of so many Mariners in so
many goodly and costly ships, in long
and dangerous voyages, for whose vic
(though many other wayes profitable)
this little booke is chiefly behoouefull:
may chalenge an interest in these his
labours. This *Book* is noble by birth, as
being descended from a Noble Parent,
& not ignoble by educatiō, hauing lear-
ned to speake English of my late Fa-

ther, a man in the iudgment of the learned, and experience of the common sort, famous for knowledge and practise in the Mathematickes : whose care thereof was so great, to send it abroad with the true resemblance of his worthy father, and sufficient knowledge of the English tongue to instruct our Countrey-men, that hee procured the Authors perusall of it: who after great paines taken therein, gaue approbation to it, both in substance and forme, as now I present it vnto you. I am the bolder thus to do, in regard it is not vnknowne to many men, that my said father spent a great part of his time in study of the Art of Nauigation, and had gathered much vnderstanding by his owne practise in some voyages to sea with the right Honourable the Earle of *Cumberland* deceased: whereupon he published a painful worke discovering errours committed by Mariners in that Art, with corrections and ready wayes for reformation therof. So that I thinke it is out of doubt, that his iudgement therein was great. And seeing hee not onely gaue much commendation of this worke (and often in my hearing) as of very great vse for Mariners :

ners:but also to help the want of those
that could not vnderstand it in Latine,
translated the same into English, and
added thereto an instrumentall Table
to finde the part proportional,whereof
also the noble Author approued well. I
doubt not but it is apparant enough
that he esteemed of it, and intended to
haue recommended it as a booke of
more then ordinary worth,especially to
Sea-men. But shortly after he had it re-
turned out of *Scotland*,it pleased God
to call him away afore he could pub-
lish it, or but write a description of the
said instrumentall Table which he had
deuised, therefore hee left the publish-
ing of it to me, as an inheritance, and
the said description to his learned and
kind friend Mr. *Henry Briggs*, who
hath performed it accordingly. All
which I humbly present vnto you, ho-
ping you shall receaue as much profite
by the vse of it, as there hath been lear-
ning, care, and paines bestowed in the
penning and fitting it thus to your
hands.



TO THE MOST
NOBLE AND HOPE-
FULL PRINCE,
CHARLES:
ONLY SONNE OF
the high and mightie IAMES by
the grace of God, King of great Brit-
taine, France, and Ireland: Prince
of Wales: Duke of Yorke and
Rothesay: Great Steward of
Scotland: and Lord of
the Islands.

MOST NOBLE PRINCE,



EEING there is neither
study, nor any kinde of lear-
ning that doth more acuate
and stirre vp generous and
heroicall wits to excellent
and eminent affaires: and
contrariwise that doth more deiect and keepe
downe sottish and dull mindes, then the Ma-
thematickes. It is no maruell that learned
and

Dedicatorie.

and magnanimous Princes in all former ages - haue taken great delight in them, and that unskilfull and slothfull men haue alwayes pursued them with most cruell hatred, as vtter enemies to their ignorance and sluggishnesse. Why then may not this my new inuention (seeing it abhorreth blunt and base natures) seeke and flye vnto your Highnesse most noble disposition and patronage? and especially seeing this new course of Logarithmes doth cleane take away all the difficultie that heretofore hath beene in mathematicall calculations, (which otherwise might haue beene distastfull to your worthy towardnesse) and is so fitted to helpe the weaknesse of memory, that by meanes thereof it is easie to resolue moe Mathematical questions in one houres space, then otherwise by that wonted and commonly receiued manner of Sines, Tangents, and Secants, can bee done euen in a whole day. And therefore this inuention (I hope) will bee so much the more acceptable to your Highnesse, as it yeeldeth a more easie and speedy way of accompt. For what can bee more delightfull and more excellent in any kinde of learning then to dispatch honourable and profound matters, exactly, readily, and without losse of either time or labour. I craue therefore (most gracious Prince) that
you

Dedicatorie.

you would (according to your gentlenesse)
accept of this gift) though small, and farr e
beneath the height of your deservings, and
worth) as a pledge and token of my humble
service: which if I understand you doe, you
shall (even in this regard onely) encourage
me that am now almost spent with sicknesse,
shortly to attempt other matters, perhaps
greater then these, and more worthy so great
a Prince. In the meane while, the supream
King of Kings, and Lord of Lords long de-
fend and preserve to vs the great lights of
great Brittain, your renowned parents, and
your selfe the noble branch of so noble a
stemme, and the hope of our future tranqui-
litie: to him be given all honour and glory.

Your Highnesse most
deuoted Seruant,

JOHN NEPAIR.



The Authors Preface to
the Admirable Table of Loga-
rithmes,



BEING there is nothing
(right well beloued Students
in the Mathematickes) that is
so troublesome to Mathema-
ticall practise, nor that doth more mo-
lest and hinder Calculators, then the
Multiplications, Diuisions, square and
cubical Extractions of great numbers,
which besides the tedious expence of
time, are for the most part subiect to
many slippery errors. I began therefore
to consider in my minde, by what cer-
taine and ready Art I might remoue
those hindrances. And hauing thought
vpon many things to this purpose, I
found at length some excellent brieue
rules to be treated of (perhaps) hereaf-
ter. But amongst all, none more profi-
table then this, which together with
the hard and tedious Multiplications,
Diuisions, and Extractions of rootes,

The Authors Preface.

doth also cast away from the worke it
selfe, euen the very numbers themselues
that are to be multiplied, diuided, and
resolved into rootes, and putteth other
numbers in their place, which performe
as much as they can do, onely by Ad-
dition and Subtraction, Diuision by
two, or Diuision by three: which secret
inuention, being (as all other good
things are) so much the better as it
shall be the more common, I thought
good heretofore to set forth in Latine
for the publique vse of Mathematici-
ans. But now some of our Countrey-
men in this Island well affected to these
studies, and the more publique good,
procured a most learned Mathematici-
an to translate the same into our vul-
gar English tongue, who after he had
finished it, sent the Coppy of it to me,
to bee seene and considered on by my
selfe. I hauing most willingly and glad-
ly done the same, finde it to bee most
exact and precisely conformable to my
minde and the originall. Therefore it
may please you who are inclined to
these studies, to receiue it from me and
the Translator, with as much good will
as we recommend it vnto you. *Fare yee
well.*



THE PREFACE TO THE READER

By *Henry Briggs.*



ENTLE Reader, seeing I haue publickly taught the meaning & vse of this booke at *Gresham* house, and haue had some charge about this Impression committed vnto me, both by the Honourable Authour the L. of *Marchiston*, and by my very good friend Mr. *Edward Wright* the Translator. And seeing the one who hath most right, and is best able to commend it, is so farre absent, and the other hath made a most happy change of this place and life for a better: thou maist happily expect that I should write somewhat that may giue some taste of the excellent vse of it to those who by reason of the distance of place, or other occasions, cannot come to heare me. In a word therefore I will bee bold to set downe mine opinion, writing nothing but that which I hope I shall alwayes be able and willing to make good and maintaine. There hath
beene

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been for many former ages euen vnto this present, a very great deale of time and expences bestowed by most industrious, learned, and worthy men about the doctrine of Triangles, and the making of the Tables of *Sines*, *Tangents*, and *Secants*, that by the helpe of them we may attaine to the knowledge and vse of the Mathematickes, and especially of Astronomie and Nauigation, as namely by *Hipparchus*, *Ptolomey*, *Theon*, *Regiomontanus*, *Copernicus*, *Reinoldus*, *Finkius*, *Lansbergius*, *Clavius*, *Adr. Romanus*, *Joach. Rheticus*, *Valent Otho*, and *Pitiscus*. All these, and diuers others, to their exceeding praise, and the great ease & contentment of all such as set themselves to the serious studie of the Mathematickes, haue laboured much, and some of them bestowed very great cost, both of their owne estate, & also from the liberall contribution of sundry great Princes vpon the maintenance of diuers men, who for many yeares together haue wholly employed themselves to calculate these Tables. Yet notwithstanding this little Table of Logarithmes being first begun, and finished by the charge and paines of the honourable Authour alone, may for exactnesse and

M^r. Briggs Preface.

and certainty compare with all those Tables, and for ease and expedition go very farre beyond them, for all Trigonometricall operations, especially Sphæricall, and for the making of the Tables of *Prosthaphæreses* for the Planets. Which considerations may iustly warrant the Title of *The Admirable Table of Logarithmes*. But besides all this, there is an other very excellent and admirable vse of this Table, which is not at all furthered by the other Tables formerly mentioned, nor can (for any thing I know) be any other way performed, but with very great paines and losse of much time: and that is in numbers continually proportionall, hauing any two numbers giuen with their distance, or with the number of meane proportionals betwixt them, at one operation to find any one of those meane proportionals, or any one of the numbers, without the giuen numbers at any distance assigned. And because these things may to some seeme obscure, giue me leaue to explaine the by an *example*. Let the two giuen numbers be 1. and 3000. and let there be supposed foure meane proportionals betwixt them. If of these foure I desire that which is nearest

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next to the lesse extreame, that meane, (because here the lesse extreme is an vnity) is called the surfolide root of the other extreame, to wit, of 3000. and that, or any other root may farre more easily be had by these *Logarithmes* then by any rule or other way. But the finding of any root is but one particular meane proportionall, to wit, the next meane to the vnity: and this way is generall, giuing as easily the third or fourth meane as the first. And not onely where the one extreame is an vnity, but betwixt any two numbers assigned. For example, if the giuen extremes bee 19 and 738. and there shall be betwixt these two, ten meane proportionals: by this Table we may finde the 7th or 8th, or any other assigned, from the lesse or from the greater number: or if they be continued further either diminishing vnder 19. or increasing aboue 738. we may finde any of them for any distance assigned, as the fifth or sixth in the same proportion aboue 738, or vnder 19. And thus hauing two extremes giuen, and the number of meane proportionals betwixt them, we may finde any, for any assigned distance within or without. In like sort, hauing a proportion assigned

in

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in numbers, and a third number given, we may from that third number find an extreme: betwixt which and that third number shall bee any set number of meane proportionals, keeping the proportion assigned one from another. For example, if 73 £ be yearly so to be increased, as that $\frac{1}{6}$ be still to bee added vnto the former yeares summe, and I would know what is the whole at the end of seven yeares: here the proportion assigned is 16 to 17 the third number, or the beginning of the progression is 73, the meane proportionals are fixe: I would know the other extreme, to wit, the seventh from the beginning, and by this Table of *Logarithmes* I find it to bee 111 £, 11 s, 9 d $\frac{696}{1000}$, which perhaps by curious search, after the laborious ordinarie way, will bee found too great by $\frac{1}{11}$ of a peny, or thereabouts. And thus we see the admirable vse of these *Logarithmes*, not onely in the doctrine of Triangles. (which I account to bee farre the most excellent part, and which may by other Tables be performed as exactly, but nothing so speedily, or with the like ease) but also in all our common accounts of ordinary proportionall numbers: wherein wee
may

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may not expect the same exactnesse which we may attaine vnto by rule, and by long tedious practise, because this table is but small, and the numbers neuer exceed the eighth place; but wee may safely trust to it to performe all things without sensible errour: or to performe truly, so farre as can be expressed in 7 figures. And if it shall please God (who besides his other mercies hath granted this honour vnto the Author, to begin and thus farre to accomplish this admirable worke) further to grant vnto him life and competent strength, I doubt not we shall haue the worke so enlarged and perfected, that we may vse it, both with greater ease, & with exactnesse vnto the 10th place. And thus commending these things to thy consideration, and vs and all our honest studies to the Lords blessing, I euer rest a louer of all them that loue the Mathematickes,

H. Briggs.



In praise of the neuer-
too-much praised Worke and
Authour the L. of
Marchiston.

*W*Hat, like our bodies, soules rare excellence,
Our bodies bound, yet haue thereof no sight.

(*Enwomb'd with clouds of Mysteiy from sence*)
Is here (well borne, and shap't) produc'd to light;
This skill, since first men knew, still lay unknowne.

As if some meere Impossibilitie
Had stood twixt It and how it might be showne.
But now it looks like selfe-Facilitie!

How happy and acute were his Wits eyes,
That for the Mathematicks found this Key,
To ope the lockes of all their Misteries,
That from all eyes so long concealed lay.

It was at hand, and yet it was vnscene:
Inuisible, and yet was cleere to wit

As it could wish, or as it could haue beene

In Art or Nature; yet Art mist of It.

From whence a question may arise (perchance)

Whether, or no, This do extenuate

The Authors merit? No, it doth aduance

His praise the more, the lesse he toild for that.

For whom with ease hath done what none ere could

Is most like God in workes of rarest skill:

This argues He can do what ere he would

In Art with ease, if he had but a Will. (then,

* Wright (*ship-wright? no; ship-right, or righter* M. Wrights

when wrong she goes) to this, with ease, will make Tract of

Thy Rules to make the ship run rightly, when Nauigati-

She on.

*She thwarts the Maine for Praise or profits sake.
 If after-times, that still shall blesse his name,
 Shall seeke more ease than, in his easinesse,
 To worke by Figures, he must make Art lame
 (So lesse desir'd) with Eases great excessse!
 For his Rules are so firme and facill too,
 As makes Art laugh their quick-dispatch to waigh
 With Tangents and with Secants much-a-do,
 And Enuy with that ease to pine away. (sure
 O that great Lords no worse would use their lea-
 In severall kinds, then (kindly) were they Great:
 But they make small theselues with too-great pleasure:
 So, great-Lords th'are not, nor their Counterfet.*

*Scotland, two Miracles of Men, this Age
 In thee affoords the world, to future yeares:*
Bucanan. *The Tutor of our Rulers Pupillage,
 And this rare Lord, a Load-starre to his Peeres.
 The ground of whose iust praises is so sure, (wing:
 That it will beare more Fame then Fames right
 Birth, Grace, and Art, and all surpassing pure,
 Makes him more good then great, although a king.
 Then great-good Lord, liue euer in my Lines,
 By thy iust lauds that shall then (dead) reuiue,
 Vnill the Sunne forsake the beauenly Signes,
 And in the Signes of thy worth euer liue. (thee,
 To light the world through them, & them through
 And me through both, to Fame, & that through me!*

*By the unfained louer and
 admirer of his Art and
 matchlesse vertue,*

John Dauies of Hereford.



In the iust praise of this
Booke, Authour, and
Translator.

Arts, in theſelues, haue ſuch diuine Perfection;
As Human reaſon cannot alwaies ſee;
Yet God all good, to man giues ſuch direction
As hidden things ſometimes diſcouered bee:
What many men and ages could not finde,
Is, at the laſt, by ſome one brought to mind.

This noble Author firſt due honour gaue
To him from whom true honours doe proceed, *
Who now to him doth graciouſly vouchſaue
Beſides his Stile, much honour for his meed,
By bringing Him thus clearly to reueale
Such profit both to Church & Comon-weale.

This little Booke (to let the other paſſe)
As Title ſhewes, is truly admirable;
Th'inuention rare, for praſtiſe nothing leſſe,
Briefe, eaſie, plaine, and paſſing delectable.
What earſt was hard and tedious to vnfold,
Here how to find with eaſe, is plainly told.

The toyleſome Rules of due Proportion
Done here by Addition and Subtraction,
By Bi partition and Tripartition,
The ſquare and cubicke rootes extraction:
And ſo, all queſtions Geometricall,
But with moſt eaſe Triangles-ſphæricall.

By his
worke on
the Reuelation, firſt
printed in
Ano. 1593
And a-
gaine in
Ano 1611.

The vse is great in all true Measuring
Of Lands, Plots, Buildings, and Fortification,
So in Astronomie and Dialling,
Geography and Nauigation.

In these and like, yong students soone may gaine,
The skilfull too, may saue cost, time, & paine.

In Latine to the world it first appear'd

Mr Wright Strange vnto them to whom that tongue is strange:
detected But he who earst our Nauigation clea'd,
& corre- From that strange tongue to English it did change.
cted ma- That famous, learned, Errours true Corrector,
ny errors England, great Pilot, Mariners Director.
in the vul- whose care thereof was such, that he obtain'd
gar Naui- The Authors Approbation, and withall,
gation. He, for the helpe of Practisers ordain'd.

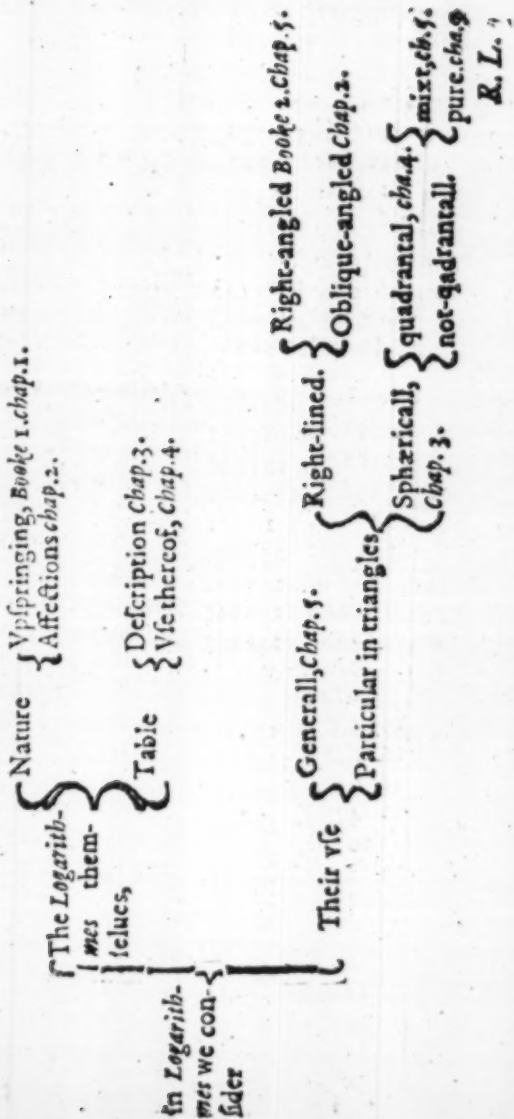
A way to finde the part Proportionall:
The vse whereof too-timely death deny'd,
Which famous Briggs hath learnedly supply'd.

Thus haue you here the quintessence of Art,
Fitted to hand by men of rarest skill,
Whose everlasting prailes in each part
So farre extend that here conclude I will.

And say, For Matter, Author, and Translator,
Nere had these Arts so good a Demonstrator.
Pulchra hæc facilia.

Ri. Leuct.

A VIEW OF THIS BOOKE.



Some faults haue eſcaped in printing of the Table,
 which the practiſer (if it pleaſe him to take the
 paines) may eaſily correct afore he uſe the Table,
 after this manner, or what elſe he ſhall find.

De.	m.		De.	m.	
0	10	Diff. 5839981	62	18	Sine 885392
0	11	Sine 3200	28	34	Diff. 607955
1	11	Sine 23560	61	1	Sine 874761
1	60	Log. 3355282	60	47	Log. 136071
2	1	Log. 3346986	60		Sine 874620
4	46	Log. 2487733	29	59	Diff. 549978
85	0	Sine 996195	60	20	Log. 140504
83	44	Sine 994025	21		Log. 140339
	3	Sine 992652	7		Log. 142668
8	33	Diff. 1894833	57	30	Sine 843391
81	30	Sine 989015	14		Sine 840882
11	18	Sine 195946	33	59	Log. 581692
	24	Log. 1621220	54	5	Log. 210813
78	42	Log. 19576	36	28	Sine 594355
13	45	Sine 237686	53	1	Diff. 233560
	46	Sine 237968	7		Diff. 287193
	47	Sine 238251	52	15	Log. 234850
	48	Sine 238533	38	26	Log. 475452
	49	Log. 1432062	59		Log. 463474
	50	Log. 1430880	51	0	Sine 777146
15	5	Sine 260224	4		Sine 777878
16	26	Diff. 1220955	19		Sine 780612
21	6	Sine 359997	38	49	Log. 467079
22	4	Diff. 902930	44		Log. 468889
	50	Log. 946616	39	13	Sine 632255
23	2	Log. 938366			
24	58	Diff. 764429			
64	2	Sine 899049			
27	4	Sine 455027			
	11	Sine 456839			
	20	Diff. 659953			
	31	Sine 461007			
62	30	Sine 887011			



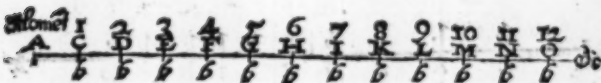
**A DESCRIPTION
OF THE ADMIRABLE
TABLE OF LOGARITHMES,
WITH THE MOST PLEN-
TIFVL, EASIE, AND READY
Vse thereof in both kindes of
*Trigonometrie, as also in all Ma-
thematicall Accounts.***

THE FIRST BOOKE.

**CHAP. I.
Of the Definitions.**



A LINE is said to increase equally, i. Definiti-
when the poynt describing the same, on-
goeth forward equall spaces, in
equall times, or moments.



Let A be a poynt, from which a line is to be
drawne by the motion of another poynt,
which let be B.

Now in the first moment, let B moue from
B A

A to C. In the second moment from C to D. In the third moment from D to E, & so forth infinitely, describing the line ACDEF, &c. The spaces AC, CD, DE, EF, &c. And all the rest being equall, and described in equall moments (or times.) This line by the former definition shall be said to increase equally.

A Corollary
or conse-
quent.

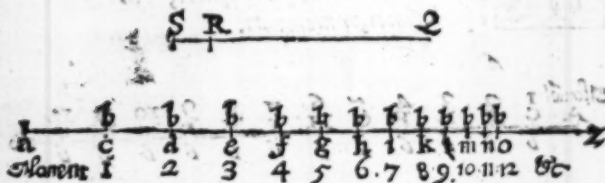
Therefore by this increasing, quantities equally differing, must needs be produced, in times equally differing.

As in the Figure before, B went forward from A to C in one moment, and from A to E in three moments. So in sixe moments from A to H: and in 8 moments from A to K. And the differences of those moments, one and three, and of these 6. and 8 are equall, that is to say two.

So also of those quantities AC, and AE, and of these, AH, and AK, the differences CE, and HK are equall, and therefore differing equally, as before.

2. Definiti-
on.

A Line is said to decrease proportionally into a shorter, when the poynr describing the same in equall times, cutteth off parts continually of the same proportion to the lines from which they are cut off.



For examples sake. Let the line of the whole sine a Z be to bee diminished proportionally: let the poynr diminishing the same by his motion

motion be b : and let the proportion of each part to the line from which it is cut off, be as Q R to Q S. Therefore in what proportion Q S is cut in R, in the same proportion (by the 10 of the 6 of Euclid) Let a Z be cut in c . and so let b . running from a to z in the first moment, cut off a c from a Z, the line or sine c Z remaining.

And from this c Z let b proceeding in the second moment, cut off the like segment, or part, as Q R to Q S: and let that bee c d, leaving the sine d Z. From which therefore in the third moment, let b in like manner, cut off the segment d e, the sine e Z being left behinde. From which likewise in the fourth moment, by the motion of b , let the segment e f be cut off, leaving the sine f Z. From this f Z in the fifth moment, let b in the same proportion cut off the segment f g, leaving the sine g Z, and so forth infinitely. I say therefore out of the former definition, that here the line of the whole sine a Z, doth proportionally decrease into the sine g Z, or into any other last sine, in which b stayeth, and so in others.

Hence it followeth that by this decrease in equal moments (or times) there must needs also bee left proportionall lines of the same proportion.

A Corollary.

For what continuall proportion there is before of the sines to be diminished, a z, c z, d z, e z, f z, g z, h z, i z, and k z, &c. and of the segments cut off from them, a c, c d, d e, e f, f g, g h, h i, and i k, there must needs be also the same proportion of the sines remaining, that is, c z, d z, e z, f z, g z, h z, i z, and k z, as may manifestly ap-

4 *The first Booke.* CHAP. I

peare by the 19 Prop. 5. and 11. Prop. 7, Euclid.

3 Def.

Surd quantities, or vnexplicable by number, are said to be defined, or expressed by numbers very neere, when they are defined or expressed by great numbers which differ not so much as one vnite from the true value of the Surd quantities.

As for example. Let the semidiameter, or whole line be the rational number; 10000000 the sine of 45 degrees shall be the square root of 50,000,000,000,000, which is surd, or irrational and inexplicable by any number, & is included between the limits of 7071067 the lesse, and 7071068 the greater: therefore, it differeth not an vnite from either of these. Therefore that surd sine of 45 degrees, is said to be defined and expressed very neere, when it is expressed by the whole numbers, 7071067, or 7071068, not regarding the fractions. For in great numbers there ariseth no sensible error, by neglecting the fragments, or parts of an vnite.

4 Def.

Equall-timed motions are those which are made together, and in the same time.

As in the figures following, admit that B be moued from A to C, in the same time, wherein b is moued from a to c the right lines AC & ac, shall be sayd to be described with an equall-timed motion.

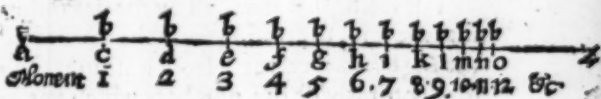
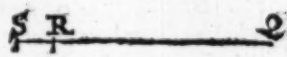
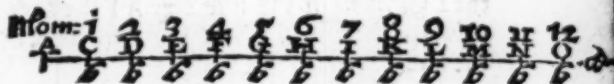
5 Def.

Seeing that there may bee a slower and a swifter motion giuen then any motion, it shall necessarily follow, that there may be a motion giuen of equall swiftnesse to any motion (which wee define to be neither swifter nor slower.)

6 Def.

The Logarithme therefore of any sine is a number very neerely expressing the line, which increased

sed equally in the meane time, whiles the line of the whole sine decreased proportionally into that sine, both motions being equal-timed, and the beginning equally swift.



As for example. Let the 2 figures going afore bee here repeated, and let B bee moued alwayes, and euery where with equall, or the same swiftnesse wherewith *b* beganne to bee moued in the beginning, when it was in *a*. Then in the first moment let B proceed from A to C, and in the same time let *b* moue proportionally from *a* to *c*, the number defining or expressing A C shal be the *Logarithme* of the line, or sine *c* Z. Then in the second moment let B bee moued forward from C to D. And in the same moment or time let *b* be moued proportionally from *c* to *d*, the number defining A D. shall bee the *Logarithme* of the sine *d* Z. So in the third moment let B go forward equally from D to E, and in the same moment let *b* be moued forward proportionally from *d* to *e*, the number expressing A E the *Logarithme* of the sine *e* Z. Also in the fourth moment, let B proceed

ceed to F, and b to f , the number A F shall be the *Logarithme* of the sine fz . And keeping the same order continually (according to the former definition) the number of A G shall be the *Logarithme* of the sine gz . A H the *Logarithme* of the sine hz . A I the *Logarithme* of the sine iz . A K the *Logarithme* of the sine kz , and so forth infinitely,

Therefore the Logarithme of the whole sine A consequēt. 1000000 *is nothing, or 0; and consequently the Logarithmes of numbers greater then the whole sine, are lesse then nothing.*

For seeing it is manifest by the definition, that the sines decreasing from the whole sine, the *Logarithmes* increase from nothing: therefore contrariwise the numbers which yet we call Sines, increasing vnto the whole sine, that is to 1000000, the *Logarithmes* must needs decrease to 0. or nothing: and by consequent the *Logarithmes* of numbers increasing about the whole sine 1000000, which wee call Secants, or Tangents, and no more sines, shall be lesse then nothing.

Therefore we call the Logarithmes of the sines Abounding, because they are alwayes greater then nothing, and set this marke + before them, or else none. But the Logarithmes which are lesse then nothing, we cal Defectiue, or wanting, setting this marke — before them.

It was indeed left at libertie in the beginning, to attribute nothing, or 0. to any sine or quantitie for his *Logarithme*: but it was best to fix it to the whole sine, that the Addition or Subtraction of that *Logarithme* which is most frequent in all Calculations, might neuer after be any trouble to vs.

CHAP. II.

Of the Propositions of Logarithmes.

THE Logarithmes of Proportionall numbers and quantities are equally differing. *Propos. 1.*

As for example. The Logarithmes of the proportionall lines, namely $e z$, which is to $e z$, as $h z$ is to $k z$, are respectively the numbers defining AC , AE , AH , AK , (as is manifest by the 6 Definition.) Now AC , and AE differ by the difference CE , and AH and AK by the difference HK . But by the first definition and his Corollarie CE and HK , are equall: therefore the Logarithmes of the fore-said proportionall lines are equally differing. And so in all proportionals.

For what affections and symtomes the Logarithmes haue gotten in their first beginning and generation, the same must they needes retaine and keepe afterwards.

But in their beginning and generation, they are indued with this affection, and this law is prescribed vnto them, that they bee equally differing, when their lines or quantities are proportionall (as it appeareth by the definition of a Logarithme, and of both motions, and shall hereafter more fully appeare in the making of the Logarithmes.) Therefore the Logarithmes of proportionall quantities are equally differing.

Of the Logarithmes of three proportionals, the double of the second or meane, made lesse by the first, is equall to the third. *Propos. 2.*

Seeing that by the first propos. the difference of the *Logarithme* of the first and second, is equall to the difference of the *Logarithmes* of the second and third, that is, the second made lesse by the first, is equall to the third, lesse by the second: therefore the second being added to both sides of the equation twice, the second, or the double of the second made lesse by the first, shall come forth equall to the third, which was to bee proved.

Propos. 3.

Of the Logarithmes of three proportionals, the double of the second, or middle one, is equall to the summe of the extremes.

By the second Proposition next going before, the double of the second, made lesse by the first, is equall to the third. To both the equall sides adde the first; and there shall arise the double of the second equall to the first and third, that is, to the summe of the extremes, which was to bee demonstrated.

Propos. 4.

Of the Logarithmes of foure proportionals, the summe of the second and third, made lesse by the first, is equall to the fourth.

Seeing by the first Proposition of the *Logarithmes* of 4 proportionals, the second made lesse by the first, is equall to the fourth lesse by the third: adde the third to both sides of the equality, and the second and third made lesse by the first, shall bee made equall to the fourth, which was propounded.

Propos. 5.

Of the Logarithmes of foure proportionals, the summe of the middle ones, that is, of the second and third, is equall to the Logarithme of the extremes, that is to say, the first and fourth.

By the 4 proposition going afore the 2 & third

CHAP. 3. *The first Booke.* 9

third made lesse by the first, were equall to the fourth: to both sides of the equality adde the first, and the second more by the third shall bee made equall to the fourth, more by the first, which was to be demonstrated.

Of the Logarithmes of foure continuall proportionals, the triple of either of the middle ones, is equall to the summe of the further extreame, and the double of the neerer. Propos. 6.

By the second proposition, the double of the second made lesse by the first, is equall to the third; and by the third proposition the double of this, that is, the fourefold of the second made lesse by the double of the first, shall be equall to the summe of his extreames, that is, the fourth more by the second. Now, if from both sides of the equality you subtract the second, the triple of the second made lesse by the double of the first, shall be made equall to the fourth. Again, to the sides of this equality adde the double of the first, and there shall arise the triple of the second, equall to the fourth, more by the double of the first, which wee vnderooke to proue.

An Admonition.

Hitherto we haue shewed the making and symptomes of *Logarithmes*; Now by what kinde of account or method of calculating, they may be had, it should here bee shewed. But because we do here set down the whole Tables, and all his *Logarithmes* with their Sines to euery minute of the quadrant: therefore passing ouer the doctrine of making *Logarithmes*, til a fitter time, we make haste to the vse of them: that the vse and profit of the

thing being first conceiued, the rest may please the more, being set forth hereafter, or else displease the lesse, being buried in silence. For I expect the iudgement and censure of learned men hereupon, before the rest rashly published, be exposed to the detraction of the enuious.

CHAP. III.

Containing the description of the Table of Logarithmes, and of the seuen Columnnes thereof.

1 Section.



THE first Columnne is expressly of the Arches increasing from 0 to 45 degrees, and is also understood to bee of their remainders to a semicircle.

2 Section.

The seventh columnne is of arches decreasing from a quadrant to 45 degrees, and is also understood to bee of their remainders to a semicircle.

3 Section.

So the Arches of the one columnne are the complements of the Arches of the other answering ouer-against them.

4 And in the first is expressed the lesse sharpe angle of any right-lined right-angled triangle.

5 But in the seventh ouer against it, is placed the greater sharpe angle of the same right-angled triangle.

6 In the second columnne are the sines of the arches of the first columnne.

7 And these are the lesse legges subtending the lesse angle of a right angled triangle, whose Base, or Hypotenuse is the whole sine.

8 In the sixth columnne are the sines of the arches of the seventh columnne.

9 And

CHAP. 3. The first Booke. II

And these are the greater legges subtending
the greater sharpe angle of the same right-angled
triangle, whose Hypotenuse is the whole sine.

Hence it followeth, that of the whole sine, and
the sine of the second columnne, and the sine of the
sixth columnne answering ouer-against the same,
there is made a triangle that is equiangled, and
like to any right-angled right-lined triangle.

The third columnne containeth the Logarithmes
of the arches and sines towards the left hand.

Which are the Logarithmes of the proportion
of the lesse legge of a right-angled triangle, to the
Hypotenuse of the same.

And they are also the Logarithmes of the com-
plements of the arches and sines towards the right
hand, which we call Antilogarithmes.

The fift columnne containeth the Logarithmes
of the arches and sines towards the right hand.

Which are the Logarithmes of the proportion
of the greater legge of a right-angled triangle, to
the Hypotenuse of the same.

They are also the Antilogarithmes of the
arches and sines towards the left hand, or the Lo-
garithmes of the complements.

Lastly, the fourth or middle columnne contai-
neth the differences betwene the Logarithmes of
the third and fift columnnes. And so this columnne
is two-fold, Abounding and Defectiue.

Those differences are Abounding, which arise
out of the subtraction of the Logarithmes of the
fift columnne from the Logarithmes of the third
columnne.

But the differences arising by subtraction of
the Logarithmes of the third columnne out of the
Logarithmes of the fift columnne, are Defectiue,
which therefore are lesse then nothing.

The Abounding differences are called the dif-
ferentiall

ferentiall numbers of the arches towards the left hand.

21 And are the Logarithmes of the proportion of the lesse legge of a right-angled triangle, to the greater legge of the same.

22 And are also the Logarithmes of the Tangents of the left hand arches.

23 But the defectiue Differences, are called the differentiall numbers of the right hand arches.

24 And are the Logarithmes of the proportion of the greater legge of a right-angled triangle, to the lesse legge of the same.

25 And are also the Logarithmes of the Tangents of the right-hand arches.

26 Also euery left hand arch, and the remainder thereof to a semicircle, is called the arch of the complement of the arches, sines, & right hand Logarithmes, and of the Defectiue differentials.

27 And contrariwise euery right hand arch, and the remainder thereof to a semicircle, is called the arch of the complement of the arches, sines and left hand Logarithmes, and of the Abounding differentials.

Admonitions.

28 **H**ERE it is to be noted, that if you make the Logarithmes of the third columnne Defectiue setting before them this marke, — they shall bee made the Logarithmes of the Hypotenuses or Secants of the right hand arches of the seventh columnne.

29 And these also shall bee made the Logarithmes of the proportion of the Hypotenuse of a right-angled triangle to the lesse legge of the same.

30 And if you make the Logarithmes of the fifth columnne Defectiue, they shall bee the Logarithmes of the Hypotenuses, or of the Secants of the left hand

band arches of the first columnne.

The same shall also be the Logarithmes of the proportion of the Hypotenuse of a right-angled triangle to the greater legge of the same. But because the sines onely, and their arches, and the Logarithmes with their Differentials, are sufficient for attaining the knowledge of right-lined triangles, and for the knowledge of sphericall triangles, the arches onely with their Logarithmes and Differentials are sufficient without regard of the sines. Therefore we have excluded the Tangents, and the Hypotenuses, or Secants, out of the Table: and in sphericall triangles we will have the sines also not regarded; yet we will shew you by the way, that you may, if you list, use them all readily enough in right-lined triangles, but not in sphericall.

CHAP. IV.

Of the use of the Table, and of the numbers thereof.

THe Sines, Tangents and Secants being precisely found in their Tables, to finde their Logarithmes as precisely. Sect. 1.

By the 11 and 14 Section of the third chapter, the Sine giuen being found in the second, or sixth columnne of our Table, the Logarithme thereof shall bee found in the third or fifth columnne of the same line.

So therefore, the Logarithmes of the Sines that are in the table are exactly had. And the numbers of the Tangents and Secants being found in their owne Tables, you haue their arches.

And

And the arches being knowne, our Table giueth you the *Logarithmes* of the Tangents, or the differentials with their signes or marks in the middle columnne, by the 22 and 25 Sect And; the *Logarithmes* of the Secants reciprocally in the third & fifth columnnes; yet setting before them this signe — by the 28 and 30 Sect. Therefore the *Logarithmes* of the Sines, Tangents and Secants that are in the Tables, are thus had.

Examples of Sines.

I Seeke the *Logarithme* of the sine 694658. I finde that sine precisely in the second columnne, answering to the arch 44 degrees, 0 min. & in the same line of the third columnne, there standeth ouer-against it, the *Logarithme* 364335 which I sought. Also let the *Logarithme* of the sine 721357 bee sought. This sine shall bee found answering to the arch 46 degr. 10 min. and neere adioyning thereto 326620. the *Logarithme* thereof that was sought.

Examples of Tangents.

Let the *Logarithme* of the Tangent 218645 bee sought. To this Tangent there answereth in his Table the arch of 21 degr. 20 min. and to this arch in the middle columnne of our Table, answereth the *Logarithme*, or differentially abounding 1520306 which was sought. Also if you shal seeke the *Logarithme* of the Tangent 4573629. you shall finde in the Table of Tangents his arch 77 degr. 40 min. and the same differentials of this arch in our Table, but yet defectiue, that is, 1520306.

Examples of Secants.

TO the Secant 1811801 there answereth in the Table of Secants, the arch 56 degr. 30 min. and to this arch in our Table agreeeth reciprocally —594321 the defectiue Logarithme of the Secant 1811801, aboue written. So you shall find —271425, the Logarithme of the Secant 1311834. & of the secant 1396059. you shall find the Logarithme —333653.

To estimate the Logarithmes of the numbers giuen, and not found in the Tables of the Sines, Tangents, and Secants.

Secke the number that is most like the number giuen in the second or sixth columnne of our Table, whether it be ten fold; an hundred fold, a thousand fold, 10000 fold, 100000 fold, 1000000 fold: or if you will in the Tables of Tangents and Secants: and note the arche hereof. For the Logarithme thereof taken out of our Table, is that you seek for; yet keeping in minde, or for memory sake, setting downe in cyphers, the number of the places or figures of the multiplicatie. As if the Logarithme of the number 137 bee sought, which is not found in the Tables, you shall finde among the Sines 1454. 13671. and 137156. And among the Tangents 1370305. but among the Secants, the number 1370505 which is likest of all to the number giuen, if the last foure figures toward the right hand be vnderstood to be blotted out. Therefore let the Logarithme of this Secant 1370305. and of his arch 43 degr. 8. min. be sought out by the former Section, or by the 28 and 30 Sections of the third chapter, and it shall bee found —315033, which is also taken for the

the Logarithme of the number giuen 137 remembring, notwithstanding, that the 4 last figures are to be cut off, or for memory sake to be noted thus expressly — 315033 — 0000 Likewise if by the Tangent aboue expressed, 1370505. you shall seeke the Logarithme of the number 137 by the arch of that Tangent 53 degr. 53. min. shall be found by the 25 Section in the middle columnne — 315179, the Logarithme of that Tangent 1370505 which because it exceedeth 137 the number giuen by foure places; or figures. Therefore — 315179 — 0000 shall be the Logarithme of the number giuen 137; yet this Logarithme is so much lesse exact by how much 1370505 is more vnlike to the number 1370000, or the 10000. fold of the number giuen. But this error exceedeth not $\frac{1}{1000000}$. Lastly, if you shall seeke the Logarithme of the number giuen 137 by the Sine aboue written 137156. that shall bee found to bee 1986633. — 000 by this & the 11 Section of the third chapter. In like manner you shall work by the signe + when the number of the figures of the quantitie giuen, exceedeth the number of the figures of the sine that is likest thereto, which seldom happeneth. As if the Logarithme of the number (or discret quantitie) 231702 bee sought for, you shall finde in the Table, the sine 2327 most like thereto; but it wanteth two figurs. Therefore to the Logarithme hereof, found in the Table (by the 11 Sect. chap. 3) which is, 6063128. let be added two cyphers, the signe + being put betweene, and it shall be made 6063128 + 00 for the Logarithme of the number 231702. which was sought for.

But

But the best way of estimating Logarithmes, is that whereby they were first made, wherof we shall speake in another place.

Therefore as in the first Section going afore, simple and pure Logarithmes are given: so in this Section next going before by putting cyphers to them, they become impure. 3

To adde Logarithmes of like signes, is to giue the summe of them both, with their signe common to them both. 4

As by the Addition of $—56312$ to $—73495$, there shall come forth $—129807$. Also 4216 being added to $+5392$, there comes forth 9608 . So $3219—00$ added to $4360—000$ make $7579—00000$.

To adde the Logarithmes of unlike signes, is to giue the difference of them with the signe of the greater number. 5

As of the Addition of $—210$ to 332 is produced $+122$.

Also of the addition of $—210$ to 192 , comes forth $—18$.

So $—210 + 000$ added to $332—00$ are $122 + 0$.

Also $—210—000$ added to $192 + 00$, are $—18—0$.

Of two Logarithmes this is properly said to bee the Defectiue of that, and that the Abounding of this: when they haue both number and cyphers common, or the same, and all the signes $+$ and $—$ altogether contrary. 6

As of the Abounding Logarithme 56312 , the defectiue is $—56312$. Also of the Abounding Logarithme $56312—00$ the Defectiue is $—56312 + 00$. So of the Abounding Logarithme $56312 + 00$, the Defectiue is, $56312—00$.

7 To subtract an abounding Logarithme, is to adde his defectiue.

As to subtract the abounding Logarithme 56312 out of — 73495, is the same as to adde his defectiue which (by the sixth Section.) is — 56312 to the same — 73495, and they shall bee made (by the 4 going before) — 129807. So to subtract 56312 + 00 out of — 73495 — 000 is the same as to adde — 56312 + 0 to 73495 — 000, and they are made (by the 4 and 5 Sect. going before) — 129807 — 00000.

8 To subtract a defectiue is to adde his abundant.

As to subtract a defectiue — 4216 out of + 5392, is the same that it is to adde 4216 to 5392, and (by the fourth Section) to bring forth 9608. So it is the same to subtract — 4216 + 00 out of 5392 + 0, that it is to adde 4216 — 00 to 5392 + 0. and to bring forth 9608 — 0.

9 To increase or diminish a Logarithme in number, his former value remaining, is to adde to it, or subtract from it, any of the Logarithmes following, as 2302584 + 0, or 4605168 + 00, or 6907753 + 000, or 9210337 + 0000, or 11512921 + 00000, signifying nothing at all.

As let the Logarithme bee 3916 — 0 whereto if you adde any of them, as for example sake, 2302584 + 0, there shall bee made thereof 2306500 greater in number, but in value altogether the same that 3916 — 0 is: for the quantity or numerall value of this Logarithme 3916 — 0 (by the 12 and 13 Sections following of this Chapter) is 996092, from which take onely the

last

last figure, as — 0, signifieth, and it shall be made 99609. And the numeral value of that Logarithme 2306500 (by the 12 and 13 Sections following of this chapter) is also 99609 the same that was before.

An example of diminishing.

Let the Logarithme 2545177 bee to be diminished, from which if you subtract 2302584 + 0, there is left 242593 — 0 of the same value that this former 2545177 was. For the value of the simple and pure Logarithme 242593 is ten fold the value of either of them. Their values therefore are equall each to other. For the addition of the Logarithme 2302584 + 0, signifieth nothing else, but that the value of the number where-to it is added; is to be diuided into ten parts, and that one cypher is to bee added to this tenth part: but the subtraction of the same signifieth that the value of the Logarithme from whence it is subtracted, is made tenne fold more, and that one cypher is cast away from this ten fold. There remaineth therefore the same value in both of them.

So 46051684 + 00 added, signifieth that two cyphers are added to the hundreth part of the value: and being subtracted, it signifieth that two cyphers are cast away from the hundreth fold, and so of the rest aboue expressed.

An Admonition.

But because the addition and subtraction of these former numbers may seeme somewhat painfull, I intend (if it shall please God) in a second Edition, to set out such Logarithmes as shall make those numbers aboue written to fall upon decimal

decimal numbers, such as 100,000,000,200,000
000,300,000,000,&c. which are easie to bee
added or abated to or from any other number.

- 10 If therefore you shall adde to a Logarithme
that is diminished by some cyphers, or shall
subtract from a Logarithme increased by cy-
phers, any of the Logarithmes aboue written that
containe so many cyphers, there shall out of an im-
pure Logarithme bee produced, a pure one of the
same value.

As in the first example going before, let the
impure Logarithme 3916 — 0 bee to bee
purged from his cypher and signe —, adde
therefore thereto 2302584 + 0 there shall
thereof be made, as before, 2306500, the
pure Logarithme of his former value. So
from the impure Logarithme 6358447 + 00
if you subtract 4605168 + 00, (which containeth
as many cyphers) there shall remaine
the pure Logarithme 1753278, and of the
same value, whereof that former impure Lo-
garithme was.

- 11 If to a Logarithme that is Defectiue in num-
ber, you shall adde any of the foresaid Logarith-
mes of the ninth Section, that is greater in num-
ber, there shall come forth a Logarithme of the
same value Abounding in number.

As to the Logarithme — 2859527 — 0000
adde any of the numbers of the ninth Secti-
on, that is greater in number. As for exam-
ple, 4605168 + 00, and there shall bee made
thereof 1745641 — 00 of the same value,
and Abounding in number.

- 12 You may giue the Sines, Tangents, and Se-
cants, or any numerall values whatsoever, of the
Logarithmes that are found in our Table by the
II. 14. 22. 25. 28. 30. Section of the 3 Chapter,
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whether they be pure or impure.

As to the Logarithme of 36 degrees, 40 minutes 515572, in the third columnne, answereth his sine 597159 in the second columnne, & to the Defectiue therof — 515572 there answereth in the Table of Secants, 1674597, the Secant of 53 degrees, 20 minutes.

Also to the Differentiall Logarithme 295079 in the fourth columnne, answereth the Tangent 744472 in his Table, and to his Defectiue — 295079 answereth 1343233 the Tangent of 53 degrees and 20 minutes. So of the Logarithme 220493 in the fifth columnne, the numerall value in the sixth columnne is 802123, that is the Sine of 53 deg. and 20 min. and the numerall value of the Defectiue thereof, that is — 220493 is the Secant 1246691, agreeing to 36 degrees and 40 minutes.

An example of impure Logarithmes.

Let the value of the impure Logarithme 9780—0 be to be sought out; to this number, there answereth in our Table the Sine 990268, from which take the figure next the right hand (as ———0 doth shew) & they shall be made 99027, the value of the Logarithme 9780—0 which was sought. So the value of the Logarithme 2545177—00 is 7845900, because that to the pure Logarithme 2545177 there answereth in our table the Sine 78459. Also of the Logarithme 34914——00 found in the fourth columnne at 46 degrees, the value shall be 10355, because the Tangent of 46 degr. is 1035530. So of the Logarithme ———635030——00 found in the third columnne at 32 degrees, the value

value is 18871, because the Secant of the complement of 32 degrees, that is of 58 degrees, is 1887080, whose two last figures next the right hand 80, are to be blotted out for ———00 adicyned to the Logarithme.

13

To estimate the numerall values of the Logarithmes giuen, and not found in our Table.

For common measuring, it is sufficient for the most part, to take for the Logarithme giuen, the numeral value of the Logarithme in the Table, that comes neereſt that, which is giuen. But if you desire to come neerer the marke, increase or diminish in number the Logarithme giuen, by the 9 Section of this chapter, his former value remaining vntill it be either found in the Table, or become like enough to some Logarithme in the Table, and the value of this Logarithme found by the former Section, is that which we seek for. As for example, let the value of this Logarithme 2314972 + 0 be sought, to which there is none found like or neere enough in the Table; but if you subtract from it 2302584 + 0, there shall be left 12388 almost, to which vnder 81 degr. there shall be found one that is neere, and like enough to it, that is, 12388, the Sine whereof 987688 found by the former Section, is the value of the Logarithme proposed 2314972 + 0 which was sought for.

An Admonition.

FOR this and the 2 Sect. of this chapter, we would haue you admonished, that the Logarithmes of the numbers giuen, & contrariwise the numerall values of the Logarithmes giuen, when they are not found in the Table, are most exactly giuen by the way, by which

which the Logarithmes are made or resolved, which is that you descend from the sine giuen by meanes Geometrically proportionall, vntill you come to the next lesse sine in the Table. Likewise from the Logarithme hereof; in the Table, that you descend also by as many agreeable meanes Arithmetically: and the last of these shall be the Logarithme of the first of them, and contrariwise by resolution that you descend from the Logarithme giuen by Arithmetically meanes to the next lesse Logarithme in the Table, and from the value of this in the Table likewise, that you descend, by as many meanes Geometricall and agreeable: and the last of these shall bee the numerall value of the first of those Logarithmes. But what Arithmetically equalitie of difference agreeth and is fitting to euery continued Geometricall proportion, is a matter of no meane skil to finde out. Wherefore of these (if God will) we shall intreate hereafter more at large, when we shall handle the making of Logarithmes.

CHAP. V.

Of the most ample vse of the Logarithmes, and ready practise by them.



*P*f the Logarithmes of three proportionals, the middle Logarithme being giuen, and one extreame to finde the other extreame, or his proportionall, or arch by one doubling, or subtraction onely.

Seeing that by the second proposition, Chap. 2. the double of the middle (Logarithme) made lesse by one of the extreames, is made equal to the other; Therefore from the

the double of the middle Logarithme given, subtract the given Logarithme of the extreme, and there shall remaine the Logarithme of the extreme that was sought for: which being found in the third, fourth, or fifth colunne of the Table, you haue the arch answering thereto in the first and seuenth colunne, and the Sine in the second or sixth, and their Secants or Tangents in their Tables, by the third Chapter, Section 1. 2. 6. 8. 11. 14. 22. 25. 28. 30. for the extreme that was sought for. *Example.*

LET the first proportionall given, bee 1000000, and the second 707107: let the third be sought for, which commonly is found by multiplying the middle number by it selfe, & diuiding this square by the first. But we find it easilier by doubling the Log: of the middle number 346573, and by subtracting from this double (wch is 693147) the Logarithme of the first, which is 0, & there remaineth 693147, the Logarithme sought for, whose arch you shall finde to be 30 degrees, and the Sine adioyning thereto 500000, which is the proportionall number sought for. Therefore 1000000. 707107. 500000, are three proportionall numbers, the last whereof wee found onely by doubling, and subtraction, which wee promised. Also let there bee two proportionall numbers given, the first 1056256, & 766045 the second, or at least their Logarithmes — 54730, and 266515. The third you shall thus finde: From the double of this last 533030 subtract — 54730, and by the 8 Section of the 4 chapter, there is brought forth 587760, the Logarithme of 33 degrees, 45 minutes, the
fine

fine whereof 555570 is the third proportionall number that was sought for.

Out of the Logarithmes of three proportionals, P: the extreame Logarithmes being giuen, to finde the middle Logarithme and his proportionall and arch, by one addition onely, and diuision by two.

Seeing by the third proposition of the second chapter, the double of the middle Logarithme is equall to the summe of the extremes, therefore adde the Log. of the extremes, and diuide the product by 2, & there shall come forth the Logarithme of the middle proportionall number: and thereby the middle proportionall, and the arch thereof, is knowne in the columnes, and by the Sections, as before. *As for Example.*

LEt the extremes 1000000 and 500000 be giuen, and let the meane proportionall be sought: that commonly is found by multiplying the extremes giuen, one by another, and extracting the square root of the product. But we finde it easilier thus; We adde the Logarithmes of the extremes 0 and 693147, the summe whereof is 693147 which we diuide by 2 & the quotient 346573 shall be the Logar. of the middle proportionall desired. By which the middle proportionall 707107, and his arch 45 degrees are found as before. Also let the extremes giuen be 1056256 and 555570, their Logarithmes are ———54730 and 587760. The summe of these put together, is 533030 by the 5 Sect. Chap. 4. which we diuide by two, and the quotient is 266515, the Logarithme and his arch 50 degr. and the fine or meane proportionall sought for is 766044. found by addition onely, and diuision by two.

Prob. 3. Out of the Logarithmes of foure proportionals, three being giuen, or their arches, to find the fourth Logarithme with the sine and arch thereof, by one addition onely, and subtraction.

In this problem wee alwayes make the thing demanded the fourth, so that as the first of the numbers giuen is to the second, so is the third to the number demanded. And seeing the summe of the Logarithmes of the second and third of the numbers so placed, diminished by the Logarithmes of the first, is equall to the Logarithme of the fourth, by the 4. Prop. Chap. 2. Therefore adde the Logarithmes of the second and third, and from the summe of them take the Logarithme of the first, and there shall remaine the Logarithme of the fourth proportionall number demanded, and thence the fourth number it selfe, and the arch thereof.

For examples sake.

AS 766044 is to 984908: so let 500000 be to the fourth proportionall which wee seeke for. This they commonly finde by multiplying the second and third, and diuiding the product by the first. But you may find it more easily thus: Adde the Logarithme of the second 15309, and of the third 693147, the summe whereof shall be 708456: out of which subtract the Logarithme of the first, which is, 266515, and there shall remaine 441941, the Logarithme of the fourth, whose sine 642788 is the fourth proportionall desired, and the arch thereof 40 degrees. The same would come forth if (the sines being neglected) their three arches onely were giuen 50 degrees, 80 degrees, and 30 degrees. For out of the Logarithmes of the arches 80 degrees,

degrees, and 30 degrees, subtract the Logarithme of 50 degrees, there shall remaine the Logarithme of 40 degrees: and so the arch it selfe 40 degrees, shall be knowne without the sines, or their multiplication or diuision, according as we promised in the beginning.

Another Example.

AS the Tangent of 43 degrees is to the Sine of 57 degrees, so let the Tangent of 35 degrees bee to a fourth Sine vnknowne, whole arch without regard either of Sines or Tangents, we shall thus finde: Wee adde the Differential Logarithme of 34 degrees, that is, 356378 found in the middle columnne to the Logarithme of 57 degr. that is 175937 placed in the fifth columnne from the product, that is, 532316, wee subtract the Differential of 43 degrees, which is 69870, and there remaineth 462446, the Logarithme of the fourth (Sine) which being found in the third columnne, by the 11 Section of the third chapter, you shall finde close by it in the first columnne 39 degrees 2 minutes almost, which is the arch of the fourth proportionall, or Sine neglected.

Thus the arches of proportionall numbers are found without their Sines, Tangents, Secants, or any proportionall numbers whatsoever.

Which so short a way of working, doth helpe very much for measuring the angles of plaine triangles, and for the whole *Trigonometrie* of spherical triangles, as in his proper place shall appeare.

Of foure numbers in continuall proportion, the extremes being giuen, or their arches, to finde any

Prob. 4.

of the middle numbers, or any of their arches, onely by diuiding by three, instead of the troublesome extracting of the cubicke root.

Seeing that in the Logarithmes of these, the triple of any middle one, is equall to the summe of the extreme remoued, and the double of the next extreame, by the sixth proposition of the second chapter. Therefore adde the double of either extreame Logarithme to the Logarithme of the extreame remaining, and diuide the product by three, and there shall come forth the Logarithme of the middle proportionall next the former extreame, and after the same manner, the other meane proportionall also.

As for examples sake.

LET the first extreame be 402925, and the last, 1056256, the meane proportionals are sought for, which without extraction of the cubicke roote you shall thus finde. The Logarithme of the numbers giuen are 909005, and — 54730: to the double of that 1818010, adde this, and the summe shall bee 1763280, which diuided by three, bringeth forth 587760 the Logarithme, whose Sine 555570 is the first meane proportionall sought for. Also in like manner to the double of this — 54730, which is — 109460, adde that 909005, and the product will bee 799545, which diuided by three, bringeth forth 266515 the Logarithme, whose Sine 766044 is the later meane which was sought for. These therefore are foure continuall proportionals 402925, 555570, 766044 and 1056256.

Another example.

Let the extreames giuen bee 1414213,
and

and 500000: the first of these being found in the Table of Secants, the Logarithme thereof in our Table is —346573, and the Logarithme of 500000 is 693147 to the double whereof, 1386294 adde —346573, the summe shall be 1039720, which diuided by 3, will be 346573 the Logarithme of the meane proportionall next the lesse extreme, which is 707107. So to the double of —346573, which is —+ 693147, add 693147, and there shall be made thereof nothing, which diuided by 3, maketh also 0, the sine and the value whereof is 1000000 for the remaining and greater meane proportionall. These foure therefore are continually proportionall, 1414213. 1000000, 707107. 500000.

The Conclusion.

NOW out of this that is already deliuered, let the learned iudge how great benefit the *Logarithmes* bring them; seeing that by the addition and subtraction of them, and by diuiding by 2 and 3. and by other easie additions, or subtractions, multiplication, diuision: the extraction of the square and cubicke rootes, and all the great toyle of calculating is auoided, a generall taste whereof we haue giuen in this Booke.

But in the booke following we shall treat of their proper and particular vse in that noble kinde of *Geometrie* which is called *Trigonometric.*

The end of the first Booke.



THE SECOND BOOKE.

Of the excellent use of the admirable Table of Logarithmes in Trigonometrie.

CHAP. I.



SEENING that *Geometrie*, is the Art of measuring well, and measuring belongeth to Magnitudes, and Magnitudes are Figures, (at least in power) and a Figure is either a Triangle, or Triangled, and that which is triangled, is compounded, or made of Triangles: which, and whose parts, being measured, that figure also, and all the parts thereof will bee measured. It is therefore certaine, that the Arithmetical solution of any Geometricall question, dependeth on the doctrine of Triangles. A Triangle is either right-lined or spherical.

Of Right-lined Triangles.

Propos. 1.

The three Angles of a right-lined Triangle, are equal to two right Angles.

Therefore if two angles be giuen, take the summe

Summe of them out of 180 degrees, and there will come forth the third angle. Also one angle being taken out of 180 degr. the summe of the other two remaines.

A Right-lined Triangle is either right-angled, or obliquangled. In right angled triangles wee call the sides that are about the right angle, Leggs; and that which subtendeth the right angle wee call the *Hypotenuse*.

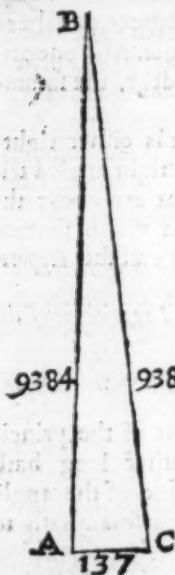
In a right-angled triangle the Logarithme of the Propos. 2. legg, is equall to both the Logarithme of the angle opposite thereto, and the Logarithme of the Hypotenuse.

Seeing it is manifest out of the principles of *Trigonometrie*, that either legg hath the same proportion to the sine of the angle opposite thereto, that the *Hypotenuse* hath to the whole sine: and (by the fifth proposition of the second chapter of the 1 book) the Logarithmes of the second and third of these foure proportionals are equall to the Logarithmes of the first and fourth: and the Logarithme of the fourth is 0, or nothing, by the Corolarie of the sixth definition of the first Chapter, and first Booke.

Therefore (as before) the Logarithme of the legge is equall to the summe of the Logarithme of the angle which it subtendeth, and the Logarithme of the *Hypotenuse*.

Therefore any two of the Hypotenuse, A Consequent legg, and angle which it subtendeth, quent. being given: the third, and thence all the rest of the parts of a right angled triangle will be knowne.

Because these three, with the whole sine,



make foure prorrporrio-
nals, it is certaine that
any of them may be put
in the fourth place, and
so be found out by the 3
Probl. of the 5 *Chap.* of
the 1 Booke.

As in the triangle A B C
right angled in A.

let the Hypotenuse B C
be given ——— 9385

with the leg A B — 9384

The oblique angles C
and B are sought for.

Therefore out of the Lo-
gar. of A B 63587—00

take the Logar. of B C
63480—00. There re-

maines 107. The Loga-
rithme of the Angle C,

whereto there answereth in the Table 89
degrées, $9\frac{1}{4}$ for the angle C, and oueragainst
it 0 degr. $50\frac{1}{4}$ for the complement ther-
of, namely the Angle B.

Contrariwise, if the Angle C bee given,
with the legge of the right angle A B, and the
Hypotenuse B C be sought for.

Out of the Logar. of A B. $\div 63587-00$

Take the Logar. of the angle C $\div 107$

And there will come forth — $\div 63480-00$
the Logarithme of B C 9385 the Hypotenuse
that was sought for.

Thirdly, if B C and the angle C being gi-
uen, and A B be sought for,

Adde the Logarithme of B C $\div 63480-00$

to the Logar. of the angle C $\div 107$

And

CHAP. I. *The second Booke.* 33

And there will be brought forth 63587—00 the Logarithme of the number 9384, answering to the legge A B, which was sought for.

No otherwise is the legge remaining A C found by the angle B. (which is the complement of the angle C) already knowne. And so all the parts of this right-angled triangle are knowne.

In a right angled triangle the Logarithme of Propof. 3. any legge is equall to the summe of the Differential of the opposite angle, and the Logarithme of the leg remaining.

Seeing it is manifest out of the common doctrine of Triangles, that either legge hath the same proportion to the Tangent of the angle opposite thereto, that the other hath to the whole sine: and seeing that (by the 5 proposition of the second chapter of the first Booke) of these foure proportionals, the Logarithmes of the middle ones, that is to say, the Differential of the angle, and the Logarithme of the legge including it, are equall to the Logarithmes of the legge subtending the same, and of the whole sine, (which is o, or nothing) therefore the Logarithme of the legge is equall to the summe, &c. as before.

Therefore of the legges of the right angle, and the angle opposite to one of them, any two being giuen, the third is knowne (by this Prop.) and therefore all the other parts of the right angled triangle by the former proposition. *Corollarie.*

Because these three, with the whole sine, doe make foure proportionals, it is certaine that euery one of them may be placed in the fourth place, and bee found out by the third Prob. of the 5 Chap. of the first Booke.

As

34 *The second Booke.* CHAP. I

As in the triangle going before A B C, right angled at A: the leggs A B being giuen 9384, and A C 137, let the angle B be sought out.

From the Logarithme A C $+4292453-00$
Subtract the Logar. of A B, $+63587-00$

And there will come forth $+4228866$ the
Differentiall of the angle B, 0 deg. 50. 11.
which was sought for.

But if the legg A C be giuen 137, and the
angle B, 0 degr. 50. 11, the legg A B, shall be
thus found.

Out of the Logarithme of A C $+4292453-00$
Subtract the Differential }
of the Angle B } $+4228866-00$

the number comming thereof $+63587-00$
is the Logarithme of the number 9384 which
is the legg sought for A B.

Thirdly, the legg A B being giuen 9384,
and the angle B, 0 deg. 50. 11. that the legg
A C may be found,

Adde the Logar. of the leg A B $+63587-00$
to the Differ. of the angle B $+4228866$

and there will come forth $+4292453-00$
the Logarithme of 137 the legg A C, which
was sought for.

The Hypotenufe B C is found by the for-
mer proposition. Also the angle C is knowne,
because it is the complement of the angle B,
already knowne. And so by this, and the for-
mer proposition, by any side, and any other
part of a right-angled triangle giuen, all the
other parts thereof are made knowne.

You haue therfore the knowledge of right-
angled right-lined triangles accomplished :
Now of oblique angled triangles.

Of Right-lined Triangles, especially obliquangled.

CHAP. II.

IN any Triangle: the summe of the Logarithmes of any angle and side inclosing the same, is equall to the summe of the Logarithmes of the side, and the angle opposite to them. Propos. 4.

Because, there is the same proportion of all the sides to the sines of the opposite angles: and so the product of the right sine of any angle, & any side including the same, is equall to the product of the side subtending the former angle, and the sine of the angle subtended by the first side. Therefore by the 5. Prop. 2. Chap. I. Booke. the summe of the Logarithme, &c. is equall, as before.

Therefore, of two angles whatsoever of a kinde Corolarie. giuen, and their subtendants: if three be giuen, any fourth will be knowne, and thence all the other parts of the triangle.

For of these foure proportionals, any that is sought for, may be put in the fourth place, & be found out by the third Prob. Chap. 5. Book I.

As of the obliquangled Triangle ABC, let AB be giuen 26302, and BC 57955, and the angle C 26 degrees: and let the angle A be sought for, which is thus found.

Adde the Logarith. of BC + 545471-0

To the Logar. of C. 26. deg. + 824689

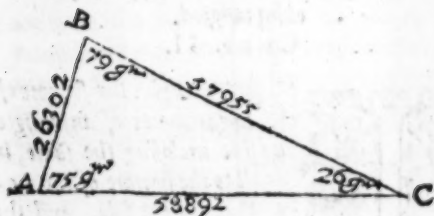
And there will bee made + 1370160-0

From thence take the } + 1335492-0

Logarithme of AB, }

There remaines ————— 34668-0 the

Loga.



Logarithme of 75 degrees, and a little more
 which is the angle A sought for: if A appeare to
 be an acute angle, otherwise 105 deg. (by the
 1 and 2 Sect. chap. 3. book. 1.) if it appeare to
 be an obtuse angle.

Contrariwise, if the angle A bee giuen 75
 degr. and the angle C, and the side BC as
 before, and AB be sought for.

Adde the Logarithme of BC $+ 545471-0$
 to the Logar. of the angle C $+ 824689$

they will be made as afore $+ 1370160-0$

From which take the } $- + 34668$;
 Logar. of the angle A }

There will come forth $+ 1335492-0$ the
 Logarithme of the side AB, and the number
 thereof 26302, which was sought for.

The angles A 75 degr. and C 26 deg. being
 now found, the angle B shal be 79 deg. (by the
 1. Prop. of this book :) out of which being now
 found, the side opposite thereto AC 58892 is
 no otherwise found then the side opposite
 thereto (AB) was lately found by the angle
 C. Therefore now all the parts of this oblique-
 angled triangle are knowne.

In the obliquangled triangles, we call them legs
 which

which are about any angle, & the base which subtendeth the same.

In obliquangled triangles, the Logarithme of the Proport summe of the legges, subtracted from the summe made of the Logarithme of the difference of the legges, and the Differentiaall of halfe the summe of his opposite angles, leaueth the Differentiaall of halfe the difference of the same.

Because as the summe of the legges is to the difference of the legges; so is the Tangent of halfe the summe of their opposite angles to the Tangent of halfe the difference of the same: Therefore they are proportionall, and by the 1 Prop. 2. Chap. 1 Book. the differences, or excesses of their Logarithmes are equall. Therefore (by the 4. Prop. 2. chap. 1. book) we must necessarily conclude as before.

Therefore by two legs, and the angle contained betweene them, are knowne by this Proposition, the other opposite angles, and thereby the other side, by the proposition going before.

For the Logarithme of the summe of the legges being subducted out of the summe made of the Logarithme of the difference of the legges, and the Differentiaall of halfe the summe of the opposite angles put together, there shall come forth the Differentiaall of halfe the difference of the same angles; which halfe difference being added to the halfe summe aforesaid, there shall come forth the greater angle; and being subtracted, the lesse.

As in the foresaid Obliquangled triangle ABC

Let there be giuen AB one legg 26302

BC th' other leg 57955

B the angle contained
betweene them, 79 degrees, and let the other
angles

angles A and C be sought for.

The summe of the legges AB, and BC is 84257, the Logar. thereof 2473882, and the difference of the same AB and BC is 31653 the Logar. thereof 3452921. And seeing the angle B is giuen 79 deg. (by the first of this book) the summe of the angles A and C will be 101 deg. and halfe the summe 50 deg. 30. the Differentiall wherof is — 193177

Which being added to the Logarithme of the difference of AB, and BC ————— } 3452921

There wil arise ————— + 3259744

Out of which subtract the Logarithme of the summe of the legs AB and BC ————— } 2473882

These will remaine ————— + 785862 the Differential of 24 deg. 30, which are the halfe-difference, of the angles A and C that were sought for.

Therefore adde this half-differ. 24 deg. 30. to the halfe summe ————— 50 deg. 30.

And they will make ————— 75 deg. 0. for the angle A, the greater of the angles sought for.

And out of the ————— 50 deg. 30.

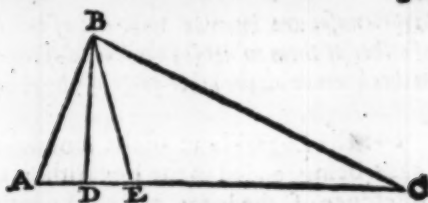
Subtract the same ————— 24 deg. 30.

And there will remaine ————— 26 deg. 0. for the angle C, the lesse of the angles sought for.

tiö In obliquangled triangles, the true base is alwayes, either the sum of the cases (& then the difference of the cases is called the *Alterne* base:) or the true base is the difference of the cases, & then we call the summe of the cases, the *Alterne* base.

As in the Triangle ABC.

The



The lesse case is —AD

The greater case is —DC

The sum of the cases AC, is the true base
And in this triangle take the lesse case AD,
or that which is equall to it —DE,
from the greater case —DC,
and there will remaine —EC,
the difference of the cases which we call the
Alterne base.

Contrariwise, in the triangle EBC.

The lesse case is —DE (Whereto
AD is equall)

The greater case is —DC

The difference of the cases EC is the true
base

But the sum of the cases, that is, AC, wee call
the *Alterne base*.

In obliquangled triangles, the summe of the Logarithmes of the summe, and difference of the legs Propos. 6.
is equall to the summe of the Logarithmes of the
true and *Alterne base*.

Because the true base is to the summe of the
leggs, as the difference of the leggs is to the
Alterne base; therefore (by the 5. Prop. 2. Chap. 1.
Book.) we necessarily conclude, that the Loga-
rithmes of the bases are equall to the Loga-
rithmes of the summe, and difference of the
leggs, as before.

Therefore, of an obliquangled triangle, whose sides A Corollarie
are giue, 2 right angled triangles are made, whose
Hypo-

40 *The second Booke.* CHAP. 2

Hypotenuses are knowne with one of the legges of either of them, which (by the second of this book) makes knowne all the other parts of the obliquangled triangle.

For the Logarithme of the summe of the leggs being added to the Logarithme of the difference of the leggs, and the Logarithme of the true base being taken from hence, there will come forth the Logarithme of the Alterne base (by the 4. Prop. of the 2 Chap. and 3 Problem of the 5 Chap. of the 1 Book.) Therefore halfe the summe of these bases is the greater case, and the halfe-difference is the lesse case.

As in the former triangle A B C,

Let the sides be giuen, that is to say,

The legge A B 26302

The legge B C 57955

and the true base A C 58892 and let the rest bee sought for.

The summe of the leggs is, 84257

the Logarithme thereof is — + 2473882

The difference of the legs is, 31653

and the Logar: thereof is, — + 3452927

Adde these Logarithmes together, and they will make, } — + 5926803

From w^{ch} take the Log: of } — + 2831930

the true base A C —————

There remains ————— + 3094873

the Logarithme of the number of the Al-

terne base E C ————— 45296

which add to the num- } — 58892

ber of the true base A C. } —————

And there remains ————— 104178

The halfe whereof D C ————— 52089

is the greater case.

Subtract one out of another, viz,

Out

Out of the true base AC 58892

Take the Alterne base EC 45286

And there remaines- — 13606

The halfe whereof AD. }
is the lesse case. — } 6803

Therefore of the right-angled triangle ADB, the Hypotenuse AB, and one of the legs AD being found: and of the right angled triangle BDC the Hypotenuse BC, and the leg DC being found (by the second of this chapter) the angles of the right angled triangle at A, and B, and C, are known, and by consequent, also all the parts of the oblique angled triangle proposed, are manifested by the premises. Neither should you doe otherwise if the sides of the triangle EBC, were giuen, and the other parts were sought. For out of the legges, and the true base EC, the Alterne base AC is knowne, and out of these both cases, and the rest, as before.

The Conclusion.

NOW therefore, you haue the doctrine of all right-lined triangles perfected & accomplished, which if it seeme somewhat toyle some in finding out the Logarithmes of variable right-lines; yet in calculating the motions of the planets, (in which the excentricities of the Orbs, the distances of the Auges & Apogæes the diameters of the Epicycles and other right lines, remaine the same, and invariable) their Logarithmes being once exactly set downe, shall alwayes serue after-wardes without any changing, with maruailous facilitie and certaintie.

Now

Now, there followes the Sphericall triangles, which are most hard, as they are commonly deliuered by others; but by our Logarithmes they are the most easie of all.

Of Sphericall Triangles
CHAP. III.

Sentences



N Sphericall triangles, the angle that is neereſt in quantitie to a quadrant, and the ſides ſubtending the ſame, are doubtful whether they be of the ſame, or of a diuers kind, except the account, or poſition bewray the ſame.

- 2 But euery one of the two oblique angles, is of the ſame kinde with the ſides ſubtending the ſame. Therefore knowing of what kinde the one is, it appeareth alſo of what kinde the other is.
- 3 If any angle of a triangle bee neerer to a quadrant then the ſide ſubtending the ſame: two ſides thereof ſhall be of one kinde, and the third leſſe then a quadrant.
- 4 But if any ſide of a triangle be neerer to a quadrant then the angle ſubtended thereby, two angles thereof ſhall bee of the ſame kinde, and the third greater then a quadrant.
- 5 A Sphericall triangle, is either quadrantall or not.
- 6 A quadrantall, is that whoſe ſide or angle is equall to a quadrant: whereby we teach, that the knowledge of a quadrantall that is not right angled may as eaſily be gotten, as if it were right angled.
- 7 A quadrantall triangle, is either manifold, or ſingle.
- 8 A manifold quadrantall, is either three right angled

CHAP. 4. *The second Booke.* 43

angled, or two right angled.

A three right angled triangle, is that, whereof e- 9
 uery part is equall to a quadrant.

Therefore euery triangle, each of whose three 10
 parts not being opposite, are equall to a quadrant,
 is three right angled.

A two right angled triangle, is that wherof two 11
 angles onely, and the sides subtending them, are se-
 uerally equall to a quadrant.

In euery two right angled triangle, the oblique 12
 angle, is equall to his subtending side.

Euery triangle, whereof any part is equall to a 13
 quadrant, and any oblique angle, equall to his sub-
 tendant, is two right angled.

Euery triangle hauing any two parts seuerally 14
 equall to a quadrant, and the third unequal, is two
 right angled.

All the rest are called single quadrantals. 15

Of Single Quadrantals.

CHAP. IV.

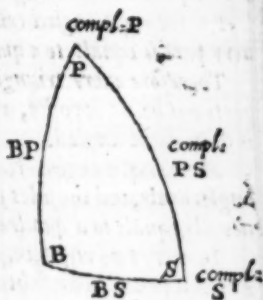


Single Quadrantall, is that 1
 whereof one part onely is equal
 to a quadrant, and the other
 five parts are not quadrants.

Of these five parts which 2
 are not quadrants, those three
 which are furthest remoued
 from the right angle, or the side that is a quadrant,
 we turne into their complements, and retaining
 the old order, we bring them all five into a circu-
 lar, or quinquangled situation, and wee call them
 Circulars.

First let the triangle B P S be right angled in
 B, the five oblique parts therof which are not
 quadrants are these, B P, one of the sides about
 the

the right angle: P
one of the oblique
angles: P S the
side subtending
the right angle: S
the other oblique
angle: S B the o-
ther side about
the right angle,
for which we (for
the easier calcula-
tion) take the side



it selfe B P: the complement of the angle P:
the complement of the side P S: the com-
plement of the angle S: and the side it selfe
S B, and keeping their naturall situation, we
place these five parts in order, as in the mar-
gine, and we call them Circulars.

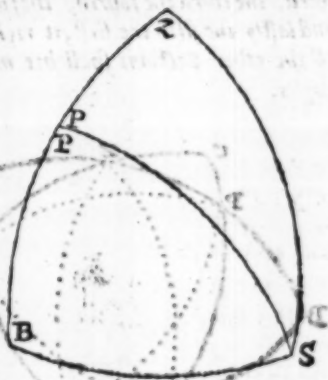
Likewise secondly, let S P Z be a quadrantal single triangle, not right angled (made of the centers of the Sunne-rising, the pole and the zenith) quadrantal in the side Z S, his five parts not quadrants are these, Zone of the angles compassed by the quadrant side: P Z the distance of the pole from the zenith: P the angle subtended by the quadrant: the side P S the distance of the pole from the Sunne: And lastly S one of the angles, about which the quadrant is: in stead whereof we for our easier account do take the angle Z or P Z S, being adioyned to a quadrant, and



is the arch of the Sunnes distance from the North. The complement of PZ , which is the elevation of the pole: the complement of the angle P , or of the angle ZPZ which is the difference ascensional (that is) the difference of the time of the Sunnes rising or setting from fixe a clocke.

The complement of the side PS , which is the declination of the Sunne: and the angle is selfe S , or PSZ , which wee call the angle of the Sunnes position (that is in respect of the Pole and Zenith.) These five parts we place in a circular or pentagonall site, as in the margine, and we call them Circulars, neither shall there be made any other circular parts of the former right angled triangle BPS , if

you make P the Pole: S the Sunne: B the North-point: for the side BP will be the elevation of the pole: the complement of P the difference ascensional: the complement of PS , the declination of the Sun: the complement of S the angle of the Sunnes position: and lastly, BS the Azimuth of the Sunne, which are altogether the same circular parts that were before, and placed in the same site towards the left hand that the other was towards the right,



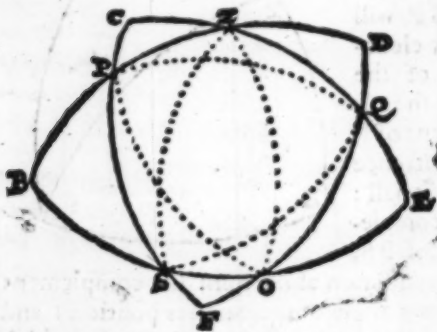
And

And so in all quadrantals, as well right-angled, as not.

Corolarie. 3 Hence it is that there bee many triangles, not conformable in their naturall parts, which in these Circular parts, doe altogether agree, and are resolved by this our methode of Circulars.

As it clearly appeareth in the two former triangles B P S, and P Z S ioyned together: In which all the naturall parts (besides P S and B S of the former, and P S, and P Z S of the latter, do altogether differ, but all the Circular parts agree, as is aforesaid.

4 This uniformitie of the Circular parts, most manifestly appeareth in right-angled triangles made on the superficies of a globe, of five great circles, the first whereof cutteth the second, the second the third, the third the fourth, the fourth the fifth: and lastly, the fifth the first, at right angles. But all the other Sections shall bee made at oblique angles.



For example sake: the meridian of any region DB cuts the Horizon BE in the poynt B. The Horizon BE cuts the circle EC, which compasseth about the Sunne (that is to say, which

which is drawne about the Sun as his pole) in the poynt E. The circle E C, which compasseth the Sunne, cuts the meridian of the Sun C F in the poynt C. The meridian of the Sun C F cuts the Equator F D in the poynt F. And lastly, the Equator F D cuts the meridian (of that region D B) in the poynt D. And all these five Sections in the poynts B, E, C, F, D, are made orthogonally and at right angles. The other Sections in the points Z, P, S, O, Q being made at oblique angles. There will also bee made of these Sections five right-angled triangles, P B S, S F O, O E Q, Q D Z, and Z C P, the naturall parts whereof, although they differ, and are varied in each severall triangle, yet the five Circular parts are the same that were before without any difference.

The same uniformitie of the circular parts appeareth also in quadrants that bee not right angled, made upon the superficies of a Globe out of five poynts, the first whereof is distant from the second, the second from the third, the third from the fourth, the fourth from the fifth, and the fifth from the first by distances and arches equall to a quadrant; but the other distances of the poynts bee unequall to a quadrant. As in the same figure the poynts P from Q, Q from S, S from Z, Z from O, and O from P, are distant by spaces equall to a quadrant. But P from Z, Z from Q, Q from O, O from S, and S from P, are distant each from other by arches which are not quadrants. There will also bee made out of these distances, five quadrants not right angled, P Z Q, Z Q O, Q O S, O S P, and S P Z, whereof although the naturall parts differ, yet the circular parts remaine the same

same vncchangeable here as before, that is to say: BP the eleuation of the pole; the complement of BPS , or SPZ , the difference ascensionall: the complement of PS , which is SF , the declination of the Sunne: the complement of PSB , which is PSZ , the angle of the Sunnes position: BS the Azimuth of the Sunne, which doe indifferently agree to all the former triangles, and not to those alone, but also to all triangles which do arise of the other intersections of these ten arches drawn forth, to whole circles, which because they are many, and confused, we here let them passe, it is sufficient to haue warned by this abridgement, that all the confusion of the naturall parts, and of their rules is annoyded, and taken away by these few Circular parts, and their onely rule.

6 *Of the sixe circular parts three alwayes come in question: whereof the two first, are given, the third is sought for.*

7 *And of these three, one is in the middle, and two are the extreames which are either set about the middle, or opposite to it.*

For example sake. Let the three parts proposed in the question be these: the Azimuth of the Sunne BS : the eleuation of the Pole BP : and the ascensionall difference the complement of BPS , whereof the eleuation of the pole is called the middle, and the other two extreames are called neighbours vnto it, or set about it. But if the three parts coming in question were: the declination of the Sun. the complement of PS : the eleuation of the Pole BP : and the angle of the Sunnes position PSZ , the eleuation of the pole shal be called the middle one, as before, but the declination

elination of the Sunne, and the angle of the Sunnes position, shall bee called the extremes, remoued from the middle, or opposite to it. The like reason is in the other five.

The Logarithme of the middle one is equall to the Differentials of the extremes set about it, or to the Antilogarithmes of the opposite extremes. 8

This Theorem is proved by induction of all the three parts or triplicities which can be made, and come into question of the five circular parts of the former right-angled quadrantall B P S. But wee omit the triplicities of the latter triangle not right-angled P Z S. because all the circular parts thereof are altogether the same in quantitie which were in the former (by the 3. 4. and 5. of this chapter.) Now therefore of the five circular parts of the right-angled triangle B P S, (which are B S, or the Azimuth of the Sunne rising; the complement of B S P, or the angle of the Sunnes position: the complement of S P, or the declination of the Sunne: the complement of S P B, or the difference ascensionall; and P B, or the eleuation of the pole) The 3 which come in question of extremes, set about the middle one, are either first B S, the complement of B S P, and the complement of S P: or secondly the complement of B S P, the complement of S P, and the complement of S P B: or thirdly, the complement of S P, the complement of S P B, and P B: or fourthly, the complement of S P B, P B, and B S: or fifthly, P B, B S, and the complement of B S P.

But because in all these triplicities, the Tangent of one of the extremes is to the right sine of the middle one, as the whole sine is to Tangent of

the other extreame (as it is manifest out of the common demonstrations of Trigonometrie) therefore by our demonstrations of the 5. Prop. of the 2. Chap. 1. Booke. the Logarithmes of the middle ones (which are the Logarithme of the middle one onely, by the Corollarie of the sixt definition of the first cha. 1. Booke) are equall to the Tangents of both the extremes. But the Logarithmes of the Tangents of these extremes are the Differentials of the same (by the 22 and 25 Sect. Chap. 3. Booke 1.) Therefore the Logarithme of the middle one only, is equall to the Differentials of the extremes set about it, as we said in the former part of the Theorem. The confirmation of the latter part followeth.

Therefore of the same five circular parts the three which come into question of the extreames opposite to the middle one, are either, first P B the complement of B S P, and the complement of S P B: or secondly, B S the complement of S P and P B: or thirdly, the complement of B S P, the complement of S P B and B S: or fourthly, the complement of S P, P B, and the complement of B S P: or fifthly, and lastly the complement of S P B, B S and the complement of S P.

But in all these triplicities, or five cases, the right sine of the complement of one of the extremes is to the right sine of the middle one, as the whole sine is to the right sine of the complement of the other extreame (which is more largely demonstrated by Regiomontanus, Copernicus, Lansbergius, Pitiscus, and others: then that it can be repeated in this abridgement) therefore by our demonstrations (the 5. Prop. 2. Cha. 1. Booke the Logarithmes of the complements of these extremes, are equall to the Logarithmes
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the middle ones, that is (as is aforesaid) to the Logarithme of the middle one onely.

But the Logarithmes of the complements of these opposite extreames, are the Antilogarithmes of the very same parts, out of the definition. Sect. 13. and 16. Chap. 3. Book 1. Therefore it followeth in these cases, that the Logarithme of the middle one only is equal to the Antilogarithmes of his opposite extremes, as the latter part of the Theore^m affirmeth. Therefore the whole Theorem is manifest. Beside this prooffe now made by induction of all the cases which can happen, the same Theorem may bee also clearly perceiued by the 4 and 5 of this chapter, in the figure whereof, the like constitution of the circular parts doth argue the similitude of the analogie of the same. So that whatsoever may be truly said of any middle one, and his extreames set about, or opposite, the same cannot iustly be denied of the other foure middle ones and their extreames respectiue^{ly} set about, or opposed.

A generall Consequent.

Hence it followeth in single Quadrantals, 9
that out of any two parts giuen, any third shall be found. For alwayes either the middle one is sought for, & his Logarithme is found by adding the Differentials of the giuen extreames set about, or one of the extremes is sought for & his Differential ariseth out of the subtraction of the Differentia^l of the other extreme giuen out of the Logarithme of the middle one already knowne, as in the five former triplicities of a right-angled triangle of the Theorem going before, and as many of a not-right-angled triangle: or else the middle

one is sought for, and his Logarithme com-
meth forth by adding the Antilogarithmes
of the opposite extreames giuen. Or lastly,
one of the opposite extreames is sought for,
and his Antilogarithme is found by subtra-
ction of the Antilogarithme of the other op-
posite extreme already giuen out of the Lo-
garithme of the middle one already knowne.
*As in the siue latter cases of the right angled trian-
gle of the Theorem going before, and as many of a
not-right-angled triangle. But to euery one of
these Logarithmes, Antilogarithmes and Diffe-
rentials already found, there answere two arches
of diuers kindes. Therefore out of the kinde of the
arch sought for, knowne by the 2. 3. or 4. of this
chapter, or else by position, the true arch it
selfe shall be made knowne.*

As in the former example of the seventh
Section of this Chapter, three parts of the
question are Circular, *The Azimuth of the
Sunne, the Eleuation of the Pole, the Difference
Ascensionall*: that is, in the right-angled tri-
angle BPS , the parts are BS and PB , and the
complement of SPB : or else in the not-right-
angled triangle quadrantall PZS , the parts
are PZS , the complement of PZ , and the
complement of SPZ , of which three let the
extreames set about be giuen, that is, *The A-
zimuth of the Sunne rising* BS , or PZS , 70 de-
grees, and the difference *Ascensionall* the comple-
ment of SPB , or the complement of SPZ , 16
deg. 24 27, and the middle part PB be sought,
or the complement of PZ , which is the *Ele-
uation of the Pole*.

Let the differentiaall therefore of the com-
plement of SPZ 16 deg. 24. 27. $+1122618$

Be added to the Differentiaall of BS , or
 BZS

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B Z S 70 degr. ————— 1010683

And there will come forth + 211935 the
Logarithme of B P 54 deg. for the eleuation
of the pole sought for.

An Admonition.

BESIDES the *Eleuation of the Pole* thus now
found, there is also found by the same man-
ner of working.

2 The *Azimuth of the Sunne* by the eleuation
of the pole, and the angle of the Sunnes po-
sition giuen.

3 The *Angle of the Suns Position* out of the A-
zimuth of the Sun, and his declination giuen.

4 The *declination of the Sunne* out of the an-
gle of the Sunnes position, and the difference
Ascensionall giuen.

5 The *Difference Ascensionall* out of the Decli-
nation of the Sunne, and Eleuation of the
pole giuen.

The second Example.

LET the *Azimuth of the Sun rising* bee giuen
L B S, or P Z S 70 degr. and the *Eleuation of*
the Pole, 54. degr. which is P B, or the comple-
ment of P Z : and let the *Difference Ascen-*
sional be sought, that is, the cōplement of S P
B, or the complement of S P Z. And because
here likewise the extreame parts are set a-
bout the middle part, therefore

Take the Differentiall of the Suns Azimuth,
B S, or B Z S 70 deg. which is — 1010683

Out of the Log. of the eleua- } + 211935
tion of the Pole B P, 54. deg } —————

And there will come forth — + 1212618 the
Differentiall of S P B 16 deg. 24 37. the arch
of the *Ascensionall difference* sought for.

An Admonition.

IN imitation of this example there is found
 2 *The Declination of the Sunne* out of the difference Ascensionall, and the Eleuation of the pole giuen.

3 *The Angle of the Sunnes position* out of the declination of the Sunne, and Difference Ascensionall giuen.

4 *The Azimuth of the Sunne* out of the angle of the Sunnes position, and the declination of the same giuen.

5 *The Eleuation of the Pole* is had out of the Sunnes Azimuth, and the angle of the Sunns position giuen.

Also contrariwise there is found

6 *The Difference Ascensionall* out of the declination of the Sunne, and the angle of the Sunnes position giuen.

7 *The declination of the Sunne* out of the angle of the Sunnes position, and his Azimuth giuen.

8 *The Angle of the Sunnes Position* is had out of the Azimuth of the Sunne, and the Eleuation of the pole giuen.

9 *The Azimuth of the Sunne* out of the Eleuation of the pole, and the Difference Ascensionall giuen.

10 And lastly, *the eleuation of the Pole* is found out of the difference Ascensionall, and the Declination of the Sunne giuen.

The third Example.

IN the latter example of the same 7th Section of this chapter, these three circular parts of the question are propounded, *The Declination of the Sunne, the Eleuation of the Pole*

CHAP. 4 *The second Booke.* 55

Pole, and the Angle of the Sunnes position. These in the right angled triangle B P S, are the complements of P S, B P, and the complement of B S P. And in a not-right-angled quadrantall P Z S, they are the complement of P S, Z P, and Z S P. Of which three let the opposite extreames be giuen, that is, *the Declination of the Sun*, which is the complement of P S 11 deg. 35. 51. and *the angle of the Sunnes position*, which is the complement of B S P, or Z S P 34 deg. 19. 21. almost. And let the middle part B P be sought, or the complement of Z P, which is the eleuation of the Pole. Therefore

Let the Antilog. of the complement of P S 11 deg. 35. 51. which is ——— + 20627
 be added to the Antilog 2 + 191308 and
 of B S, 34. deg. 19. 21. 5 ———
 there will come forth ——— + 211935 the
 Logarithme of B P 54 deg. for the *Eleuation of the pole* that was sought for.

An Admonition.

Besides the Eleuation of the pole now first found after this manner, you may by the same practise haue

2 *The Azimuth of the Sunne* out his declination and the difference Ascensionall giuen.

3 *The angle of the Sunnes position* out of the difference Ascensionall, and the Eleuation of the the pole giuen.

4 *The Declination of the Sunne* out of the Eleuation of the pole, and Azimuth of the Sun giuen.

5 And lastly, you shall finde *the Difference Ascensional* out of the Azimuth of the Sunne, and the angle of the Sunnes position giuen.

The fourth Example.

Let the Declination of the Sunne be giuen the complement of SP 11 degr. 35. 51. And the Eleuation of the pole BP, or the complement of PZ 54 degrees. And let the angle of the Sunnes position the complement of B SP, or PSZ be sought for. And here likewise, because the extreame parts are opposed to the middle, therefore

Out of the Log. of BP 54 deg. $\div 211935$
take the Antilog. of the complement of PS 11. deg. 35. 51. $\div 10617$

and there will remaine $\div 191308$ the Antilogarithme of the complement of B SP. 34. deg. 19 21. almost, the angle of the Position of the Sunne sought for.

An Admonition.

Besides the angle of the Sunnes position found out by this first practise, there is found

2 By the same practise the Declination of the Sunne, out of the difference Ascensionall, and the Azimuth of the Sunne giuen.

3 The Difference Ascensionall is found out of the Eleuation of the pole, and angle of the Sunnes position giuen.

4 The Eleuation of the pole is found by the Sunnes Azimuth, and his declination giuen.

5 The Azimuth of the Sunne is found, out of the angle of the Sunnes position, and the difference Ascensionall.

6 In a contrary order, The Angle of the Sun's Position is found by the Azimuth of the Sun, and the difference Ascensionall giuen.

The

CHAP. 5. *The second Booke.* 57

7 *The declination of the Sunne* is had out of the angle of the Sunnes position, and the eleuation of the pole giuen.

8 *The Difference Ascensionall* is found out of the Sunnes declination, and Azimuth giuen.

9 *The Eleuation of the Pole* is had out of the Difference Ascensionall, and the angle of the Suns position being giuen.

10 And lastly, *The Azimuth of the Sunne* is found by the Eleuation of the pole, and the Suns declination giuen.

And so in imitation of these foure examples, thirtie seuerall questions of Circular parts in a right-angled quadrantall, and as many in a not right-angled quadrantall, are resolued by this generall Consequent, by the benefit of one Addition or Subtraction onely. But for the vnderstanding of the latter part of this Consequent, of the kindes of arches, see the 3. 4. 5 and 6 Examples of the Chapter following.

Of Not-quadrantall mixt.

CHAP. V.

Hitherto hath beene taught the doctrine of quadrantall Sphaericall triangles: there followeth now the doctrine of Sphaericall triangles not quadrantall.

1 A not quadrantall is a Sphaericall triangle, whereof neither side nor angle is a quadrant.

2 A not-quadrantall is reduced to two quadrantalls, if from the top either a perpendicular or a

D 5 quadrant

quadrant arch be let downe to the base (extended as need shal be)

3 The perpendicular falles within the triangle, if the angles at the base bee both of one kinde; but it folies without if they bee of diuers kindes, and contrariwise.

4 The quadrant arch falles without the Triangle if the legs be of one kinde; but within if they bee of diuers kindes, and contrarise.

5 Out of the fixe parts of a not quadrantall three giuen only, are sufficient to get knowledge of the rest, except of the three giuen, whereof one is opposite to the other, the third be neerer to a quadrant, then the other giuen of the same kinde: for in this case it is required also, that the kind of the part which is opposite to the third be also giuen, that the other parts may be knowne.

Examples of this case are the 4 and 6 examples following.

6 The three parts giuen are either mixt or pure.

7 They are mixt whereof one is of a diuers kinde from the other two: As when two sides and any angle are giuen, or two angles with any side.

8 In mingled parts giuen, if from that tearme of the side giuen, in whose other terme is the angle giuen, a perpendicular or a quadrant arch subtending that angle, fall to the base, the not-quadrantall triangle shall be reduced to two quadrantalls that may be known by the 9 Sect. of the 4 chap of this booke.

And therefore, the parts of a not-quadrantall, because they are all one with the parts, or remainders of these parts to a semicircle, are easily known, the kindes of the parts being yet first knowne by the second, third, and fourth Section of the third chapter of this booke, or else by position.

*An Example of two sides, and the angle
betweene them giuen.*

AS for vse and exercise sake, let there be a
spherical triangle not quadrantal descri-
bed on the superficies of the *Primum Mobi-*
le P ZS representing the pole, the zenith, and
the Sunne; whereof there be six parts.

The side P Z, which is the distance of the
pole from the
zenith, or
the comple-
ment of the
poles eleua-
tion.

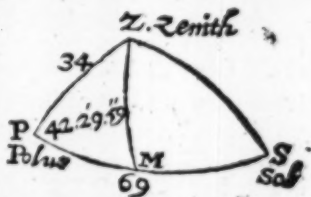
The side
Z S, the di-
stance of the zenith and Sunne, or the com-
plement of the Sunnes height.

The side P S, the distance of the pole and
the Sun, or the complement of the declina-
tion of the Sunne from the Equator.

The angle Z P S, the houre of the day, or
the degrees of the Equator.

The angle P Z S, which is the Azimuth of
the Sunne from the North.

The angle P S Z, which is the angle of the si-
tuation and position of the Sunne to the pole
and zenith.



Of these six parts let any three be giuen;
partly

partly angles, partly sides. For example sake.

The *houre angle* ZPS 42 degr. $29'$ $59''$. which sheweth two of the clock afternoone $49'$ $59''$. and $56''$.

And the side PZ 34 . the complement of the *elevation of the Pole*.

And the side PS 69 the complement of the *declination of the Sunne*.

Out of which that the other three partes may bee gotten : from Z the end of the side PZ that was giuen, let the perpendicular ZM , or rather (if you will) the quadrant ZH be drawne downe, subtending the angle ZPS , and reducing the not-quadrantall proposed PZS into two triangles quadrantall in the angle M , which are PMZ , ZMS , as in the first figure : or if you bee delighted with varietie, let them be reduced to two triangles quadrantall in the side ZH , which are ZHP , and ZHS , as in the second figure. All the parts of which quadrantals you shall get by the ninth Section of the 4th Chapter of this booke.

For by hauing PZ giuen ——— 34 deg.

and ZPM , or ZPS ——— 42 deg. $29'$ $59''$

You may find the perpend. ZM 22 deg. $11'$ $47''$

And the angle PZM ——— 52 deg. $46'$ $38''$

And the side PM ——— 26 deg. $26'$ $29''$

Which PM being taken out $\} 69$ deg.
of PS ——— $\} 69$ deg.

There remains MS ——— 43 deg. $33'$ $31''$.

Now the side MS , and the perpendicular ZM being knowne, you may (by the said ninth Section of the fourth chapter of this booke,) finde out

The angle opposite to the perpendicular MSZ , or that which was sought for PSZ 31 deg. $6'$ $5''$.

CHAP. 5. *The second Booke.* 61

And the side that was sought SZ . 47 deg.

And the angle MZS ——— 67 de. 38. 11

Which being added to PZM ——— 52 de. 46. 38

Makes PZS the angle sought 120 de. 24. 49

You haue therefore three parts which you sought for, found by helpe of the perpendicular ZM of the former figure.

You may also finde the same by helpe of the quadrant ZH in the latter figure.

For hauing PZ giuen ——— 34 deg.

And ZPS , or ZPH ——— 12 deg. 29. 59.

You may finde by the same 9. Sect. of the 4. chap. of this booke,

The angle ZHP ——— 22 deg. 11. 47.

And the angle PZH ——— 142 deg. 46. 38.

And the side PH ——— 116 deg. 26. 29.

Out of w^{ch} PH subtract PS 69 deg.

there remains the side SH 47 deg. 26. 29.

Which side SH being now had, together

with the angle ZHP 22 deg. 11. 47. you

may also (by the said 9 Section of the 4 chap. of this book) finde out

The angle HSZ ——— 148 deg. 53. 55.

And the remainder

therof to a semicir- } ——— 31 deg. 6. 5 that
cle, the angle PSZ } was sought for.

And the side SZ ——— 47 deg. that was sought for.

And lastly the angle HZS 22 deg. 21. 49.

which being taken out } 142 deg. 46. 38.
of HZP . ——— }

There remains PZS ——— 120 deg. 24. 49. the other angle that was sought for, in all poynts, as before.

An Admonition.

IN imitation of this example, nine diuerse questions

question may be resolued both of this, and any triangle. For by the *Elevation of the Pole*, and the *houre of the day*, and the *declination of the Sunne* that day, being giuen, there is had, as afore:

- 1 *The Azimuth of the Sunne.*
 - 2 *The height of the Sunne.*
 - 3 *The angle of position of the Sunne*: also by hauing the *declination of the Sunne*, the *angle of the Sunnes position*, and his *height giuen*, you haue
 - 4 *The Sunnes Azimuth.*
 - 5 *The Elevation of the Pole,*
 - 6 *The houre, or houre arch.*
- Also if you haue the *height of the Sunne*, his *Azimuth*, and the *height of the pole giuen*, there is found,
- 7 *The houre of the day.*
 - 8 *The declination of the Sunne.*
 - 9 *And the angle of the Sunnes Position.*

The second example of two angles giuen, and the side betweene them.

THe angles in the figures going afore, being giuen, to wit,

The houre angle $ZPS\ 42\ \text{deg.}\ 29'\ 59''$
& the azimuth of the sun $PZS\ 120\ \text{deg.}\ 24'\ 49''$
 with the side between
 them, being the compl. } $PZ\ 34\ \text{deg.}$
of the poles elevation

The other 3 parts are sought out. For as afore,

Hauing first giuen $ZM\ 22\ \text{deg.}\ 11'\ 47''$
And ————— $PM\ 26\ \text{deg.}\ 26'\ 29''$
And the angle — $PZM\ 52\ \text{deg.}\ 46'\ 38''$
 w^{ch} being taken out of $PZS\ 120\ \text{deg.}\ 24'\ 49''$
 there being left remai. $MZS\ 67\ \text{deg.}\ 38'\ 11''$

By

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By which M Z S, and Z M, already known,
there shall at length be found,

The side Z S — 47 deg. the side
sought for.

And the angle Z S M, or Z S P. 31 deg 6. 5.
the angle sought for.

And the side M S. 42. deg. 33. 31.
which being added to P M. 26 deg. 26. 29.
the side remaineth — P S 69 deg which was
sought for.

And these you haue by meanes of the per-
pendicular of the former figure. In like man-
ner you may finde the same by helpe of the
quadrant of the latter figure. For they are
found by the ninth Section of the fourth
chapter of this booke.

by hauing giuen the angle P H Z. 22. de. 11. 47

And the angle — P Z H. 142. de. 46. 38

Out of which the angle }
giuen P Z S being giue } 120 de. 24. 49

There remaines — S Z H. 22 de. 21. 49
which together with the angle P H Z. now
knowne, all the rest of the parts are brought
forth. viz.

P Z.	34 deg.
Z P S.	42 deg. 29. 59.
P S.	69 deg.
P S Z.	31 deg. 6. 5.
S Z.	47 deg.
Z S H.	148 deg. 53. 55.
S H	47 deg. 26. 29.

An Admonition.

IN imitation of this example, nine diuerse
Questions of this and of any other triangle,
are resolued.

For the houre of the day, the Eleuation of the
pole,

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pole, and the suns azimuth being giuen, there is had,

- 1 The declination of the sunne,
- 2 The angle of the sunnes position.
- 3 The height of the sunne.

Also, the houre of the day, the declination of the sunne, and angle of the sunnes position being giuen, there is had,

- 4 The height of the sunne,
- 5 The sunnes azimuth,
- 6 The height of the pole.

Also, the angle of the sunnes position, the height of the sunne, & his azimuth being giuen, there is had,

- 7 The height of the pole,
- 8 The houre of the day,
- 9 The declination of the sunne.

The third example of two sides giuen, whereof that which is neerer to a quadrant, subtendeth the angle giuen.

IN the figures afore, let there be giuen
The side — P Z. 34 deg:

And that which is neerer } Z S. 47 deg.
then it to a quadrant, — }

With that angle which } Z P S. 42 de. 29. 59
this side subtendeth — }

By the 9 Sect. of the 4. chap. of this Booke,
let there be sought out

The side Z M 22 deg: 11 47

And the angle P Z M 52 deg. 46 38.

And the side P M 26 deg. 26 29.

And in like manner you may haue

Z S M 31 deg. 6. 5. or Z S P

the angle sought for: which is most certainly known (by the 2 Sent. 3. chap. of this book)

CHAP. 5. *The second Booke.* 65

to be lesse then a quadrant, namely, that it is 31 deg 6. 5'. ad that it is not 148 deg. 53. 58

Also you may haue } M Z S 67 deg. 38. 11
the angle — }

which being added to P Z M 51 deg. 46. 38

makes the other angle — P Z S 120 dc. 24. 49.

which was sought for.

Lastly, you shall haue } M S 42 deg. 33. 31
the ease — }

Which being added to M P 26 deg. 16. 29

makes the side — P S 69 deg. which was sought for.

No otherwise (if you will) you may find out the same by helpe of the quadrant Z H of the latter figure.

The fourth example, of two giuen sides, whereof that which is lesse neere a quadrant subtendeth the angle giuen, and that which is neereft, subtendeth an angle of the kinde giuen onely.

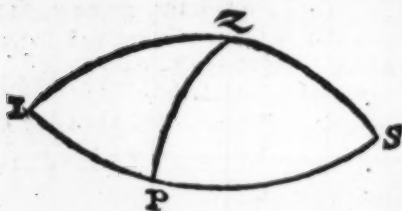
Admit there begiue } Z S 47 deg.
the sides — }

And that which is not } P Z 34 deg.
so neere a quadrant, }

with that angle which } Z S P 31 deg. 6. 5'
this subtendeth }

And let it be giue, that the angle wch ZS subtendeth, that is the angle SPZ, is by kind lesse then a quadrant: therefore the perpendicular ZM being let down from Z to the base PS (as before) or the quadrant ZI (as here) subtending the giuen angle Z S P. By the 9 Sect. of the 4 chap of this booke, let the other parts be gotten (as for exercise and varieties sake) by the quadrant of this figure, Z I, you may get

The



The angle Z I S — 22 deg. 11. 47.

And — I Z S — 157 deg. 38. 11.

And — S I — 132 deg. 33. 31.

and in like maner } I P Z — 137 deg. 30. — 1.
 you may haue }
 & by consequent } S P Z. — 42 deg. 29. 59.
 the angle — }

that was sought for.

Because by the given position, it is expressly declared to be lesse then a quadrant: otherwise except the kinde thereof were given, it would be vncertaine (by the 1. Sect. of the 3. chap. and the 5. sect. of this chap.) for it might otherwise haue been 137 deg. 30. 1.

So also shall you haue } I Z P. 37 deg. 13. 22
 the angle }

which being taken out of I Z S. 157 deg. 38. 11
 there remaines the }
 other angle sought. } P Z S. 120 deg. 24. 49

To conclude, you } — I P. 63 deg. 33. 31
 shall also haue }

Which being taken } — I S. 132 deg. 33. 31
 out of }

There remaines — P S. 69 deg. the
 side that was sought for.

You shall also hit the same markes (as it were) if you seeke the account or number of the parts, by helpe of the perpendicular Z M of the first figure.

As

An Admonition.

BY imitation of the third example going before, and this fourth, there are resolved eighteene diuerse questions of this and any other triangle. For (as it is in the 3 example) the height of the pole, the height of the Sun, & houre of the day, being giuen, there is found,

- 1 The Azimuth of the Sunne.
- 2 The angle of the Sunnes position.
- 3 The declination of the sunne.

Also, the Eleuation of the pole, the height of the sunne, and the angle of the sunnes position being giuen, (as in the fourth example) there are found,

- 4 The Azimuth of the sunne,
- 5 The houre of the day,
- 6 The declination of the sunne.

Also, the height of the sunne, the declination of the sunne, and houre of the day being giuen, there is found,

- 7 The angle of the sunnes position,
- 8 The Azimuth of the sunne,
- 9 The Eleuation of the pole.

Also, the height of the sunne, the declination of the sunne, and Azimuth of the sunne being giuen there is found,

- 10 The angle of the sunnes position,
- 11 The houre of the day,
- 12 The Eleuation of the pole.

Also, the declination of the sunne, the Eleuation of the pole, and the angle of the sunnes position being giuen, there is found.

- 13 The Azimuth of the sunne,
- 14 The height of the sunne,
- 15 The houre of the day.

Also, the declination of the sun, the height of the pole, & azimuth of the sun being giuen, you haue

The

- 16 The houre of the day,
 17 The angle of the sunnes position,
 18 The height of the sunne.

The fifth example of two angles giuen, the neerer
 whereof to a quadrant is subtended
 by the side giuen.

I N the Triangle P Z S of the first Dia-
 gram,

Let the angle P S Z { ——— 31. 6. 5"
 bee giuen ———

And SPZ which is nee-
 rer then it to a qua-
 drant { ——— 42. 29. 53.
 drant ———

With the side Z S sub-
 tending the same { ——— 47. 6. 6".

Out of which P S Z,
 and S Z, is found the { ——— 12. 11. 47.
 perpendicular SM ———

(By the 9th of the 4th of this booke.)

And the other parts
 of the quadrantal, { ——— M Z S. 67, 38, 11,
 S Z M, to wit, ———

And the side ——— M S. 42. 33. 31"

As also by this perpendicular, with the an-
 gle Z P S being giuen, or the angle Z P M,
 all the partes of the quadrantal Z M P
 are found.

As first the side sought for P Z. For this
 is most certainly knowne (by the second
 Sentence of the first Chapter of this book)
 to be lesse then a quadrant, namely, that it
 is 34, and not 146.

Then

CHAP. 5. *The second Booke.* 69

Then we haue P Z M. $52, 46, 38$,
 W^{ch} being added to S Z M. $87, 38, 11$,
 there is made the angle P Z S. $120, 24, 49$,
 Lastly, there is also had P M. $26, 26, 29$,
 W^{ch} being added to — M S. $42, 33, 31$,
 There is made the o- $\left. \begin{array}{l} \text{ther side,} \\ \text{—} \end{array} \right\}$ P S. $69, 6, 6$, that
 was sought for.

You may also finde out these parts other-
 wise (if you wil) by the two quadrantals of the
 figure next going before, Z I S, and Z I P.

*The sixth example of two giuen angles, whereof
 that which is not neereft a quadrant is subtended
 by the side giuen, and that which is neereft, is
 subtended by a side, whose kinde
 onely is giuen.*

OF the triangle P Z S of the first figure,
 let there be giuen,

The angle, Z P S, $42, 29, 59$,
 And that which is not so
 neere to a quadrant as it $\left. \begin{array}{l} \text{—} \\ \text{Z, S P. } 31, 6, 5 \end{array} \right\}$
 With the side subten- $\left. \begin{array}{l} \text{ding the same} \\ \text{— P Z. } 34, 6, 6 \end{array} \right\}$

And let it be knowne that the side Z S, sub-
 tending the angle Z P S, is lesse then a qua-
 drant.

By these thus giuen, let $\left. \begin{array}{l} \text{the perpend: be sought for.} \\ \text{Z M. } 22, 11, 47 \end{array} \right\}$

And the other parts of the quadrantall
 P Z M.

To wit the angle P Z M. $52, 46, 38$,

And the side — P M. $26, 26, 29$

As also by this perpen-
 dicular, together with $\left. \begin{array}{l} \text{the angle giuen} \\ \text{—} \end{array} \right\}$ Z S M or Z S P. $31, 6, 5$

Let

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Let all the parts of the quadrantal ZMS be sought,

As first the desired side ZS 47. 6. 68. because that by position giuen, it is expressly declared to bee lesse then a quadrant, otherwise it might haue been here 133. For (by the first Chap 3 and 5 of this booke) it is vncertaine, except the kinde thereof be expressly giuen,

Then the angle MZS—67. 38. 11 which added to the angle MZP—52. 46. 38

Maketh the angle PZS. 120. 24. 49 which was desired.

Lastly, there is also } ——— S M. 41. 33. 31
obtained

Which added to the side — P M. 26, 26, 29

Maketh the base desired — P S. 69, 6, 66

You may also most easily get the same parts out of the two quadrantals PHZ, and SMZ of the second figure.

An Admonition.

By imitation of the 5 example going afore, and this sixth, 18 seuerall questions of this and any other Triangle are resolued.

For (as in the fifth example) out of the Angle of the position of the sunne, the houre of the day, and height of the sunne being giuen, is gotten,

- 1 The Elevation of the pole,
- 2 The Azimuth of the sunne,
- 3 The declination of the sunne,

Also (as in this sixth example) by the houre of the day, the angle of position of the sunne, and height of the pole being giuen, there is gotten,

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CHAP.

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- 4 The height of the sunne,
- 5 The sunnes Azimuth,
- 6 The declination of the sunne.

Also by the houre of the day, the azimuth of the sunne, and the height of the sunne giuen, there be gotten,

- 7 The declination of the sunne,
- 8 The angle of the sunnes position,
- 9 The height of the pole.

Also by the houre of the day, the Azimuth of the sunne, and the sunnes declination giuen, you haue,

- 10 The height of the sunne,
- 11 The angle of the sunnes position,
- 12 The height of the pole.

Also by the Azimuth of the sunne, the angle of the sunnes position, and the declination of the sun giuen, there be gotten,

- 13 The height of the pole,
- 14 The houre of the day,
- 15 The height of the sunne.

Also by the azimuth of the sunne, the angle of position of the sunne, and height of the pole giuen, there be gotten,

- 16 The declination of the sunne,
- 17 The houre of the day,
- 18 The height of the sunne.

And so by the method of this Canon onely, foure and fiftie seuerall questions of the same triangle, not being quadrantall, are resolved. The rest shall bee resolved hereafter.

By these therefore it is manifest, that of two angles, and their subtending sides, three being giuen the Logarithme of the fourth of them at the least, shal be made knowne euen without any description at all of the quadrantals. For out of the sum of the Logarithmes of the angle and side adioyning there-

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to being giuen, subtract the Logarithme of the third thing that is giuen, and thence shall come the Logarithme of the fourth that was sought for; and that fourth it selfe shall also be made knowne if the kinde thereof be not unknowne.

As may be perceiued by the third, fourth, fifth, and sixth examples going before. For of the angles of the base, Z P S, and Z S P, and of their subtending leggs Z S, and Z P. let three bee giuen, (for examples sake) The leggs Z S. 47 deg. and his Logar. 312858 And — Z P. 34 deg. and his Logar. 581261 with the angle adioyning, Z P S. 42, 29, 59 & his Logar. 392172 added to the Logar. of Z P last mentioned, Their summe is, ————— + 973433 (which is the Logarithme of the secret and suppressed perpendicular Z M, or of the angle Z H S, or Z I P.)

Out of which subtract } ——— + 312858
the Logar. of Z S ——— }
There remaineth the } ——— + 660575
Log. of the 4th Z S P. }
that was sought for.

Therefore the same fourth it selfe Z S P. will be 31. 6. 5". Because (by the second Section of the third chapter) it is proued to bee lesse then a quadrant.

Now contrariwise,

There being giuen Z S } ——— + 581261
34 deg. and his Logar. }
And Z S 47 deg. and his Logar. + 312858
with the angle adioyning } & his Log. 660575
thereto Z S P, 31, 6. 5". }
added to the Logarithme of } ———
the side last mentioned, Z S, }
The summe is ————— + 973433
Our

Cut of which take the Log. of ZP + 581261

There will emaine the }
Logarithme of the 4th } ————— + 392172

the was sought for: that is, ZPS, whose
arc (by the 1st Sect. 3. Chap.) is vncertaine
whether it be 42, 29, 59, or 137, 30, 1, except
it be knowne by position giuen whether it be
greater or lesse then a quadrant.

Of not-quadrants which be pure,

CHAP. VI.



hitherto wee haue spoken of
intermingled parts giuen:
now follow such parts as
are pure.

They are pure when the
three parts giuen are of the
same kinde, and they are either
three sides giuen, and the angles are sought for: or
the three angles giuen, and the sides are sought
for.

An Admonition.

Although the pure parts are the former in re-
gard of their simplicitie, yet for their difficultie
they do worthily take the latter place.

In Spherical Triangles.

Halfe the base, and halfe the difference of the
legs being taken together, and the Logarithme
thereof, and the Logarithme of the difference of
them being added together; and out of that summe,
the summe of the Logarithmes of the legs being
subduſted, the halfe of that which remaineth is
the Logarithme of halfe the verticall angle.

Because Regiomontanus in the second chap-
ter of his fifth booke of Triangles, and others

do reach, that as the rectangle comprehended under the right sines of the legs, is to the square of the whole sine: so the difference of the versed sine of the base, and difference of the legs is to the versed sine of the verticall angle. Seeing also as that difference is to this versed sine: so is the rectangle made of the right sines of the summe, and difference of the halfe base, and halfe difference of the leggs, to the square of the right sine of halfe the verticall angle (for this last rectangle is to that difference of the versed sines, and this last square to that versed sine in a 500000 of old proportion, the whole sine being 1000000) therefore it shall follow, that as the rectangle contained under the right sines of the leggs, is to the square of the whole sine, so shall the rectangle made of the right sines of the summe and difference of the halfe base and halfe difference of the leggs, be to the square of the right sine of halfe the verticall angle. And by consequent (out of the Corolarie of the sixt Definition of the first Chapter, & the fourth Proposition of the second Chapter, and third Problem of the fift Chapter first Booke) The summe of the Logarithmes of the leggs subtracted out of the Logarithmes of the summe and difference of the halfe base, and halfe difference of the leggs, leaueth the double of the Logarithme of halfe the verticall angle, as is abouelaid.

- 4 Secondly, halfe the base, and halfe the aggregate of the leggs being taken together, and the Logarithme thereof, and the Logarithme of the difference of them being added together; & out of that summe, the summe of the Logarithmes of the leggs being subtracted, the halfe of that which remaineth is the Antilogarithme of halfe the verticall angle.

For the summe of the Logarithmes of the summe

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Summe and difference of the halfe base, and halfe summe of the legs of this proposition, hath no other proportion to the summe of the Logarithmes of the summe and difference of the halfe base, and halfe difference of the legs of the former proposition, then the double of the Antilogarithme of halfe the verticall angle here, hath to the double of the Logarithme of the same halfe verticall angle before: The demonstration whereof belongeth to another place.

An Admonition.

IN Sphericall triangles also, we take the true *Alterne* base in the same sence as before in right lined triangles, that is, the one for the sum, and the other for the difference of the cases.

Thirldy, the Differentiall of the aggregate, and the Differential of halfe the difference of the legs being added together, and out of the summe thereof the differentiall of halfe the true base being subdacted, there will remaine the Differentiall of halfe the *Alterne* base.

The fundamentall reason hereof is, because that as the Tangent of the true halfe base is to the Tangent of halfe the summe of the legs, so is the Tangent of halfe the difference of the legs to the Tangent of the *Alterne* halfe base. For the Logarithmes of Tangents are the Differentials of their arches, by the 22 and 25 Sect. 3. Chap. 1. Booke.

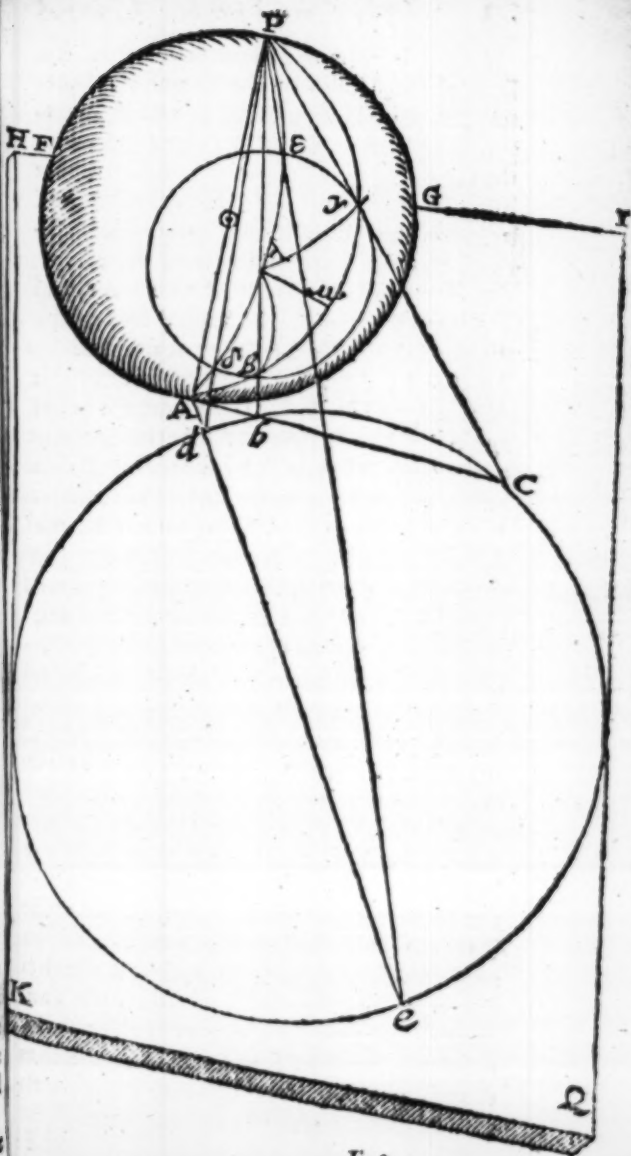
And therefore shall that equalitie of the Logarithmes or Differentials follow this analogie of the Tangents (by the 4 Prop. 2. Chap. 1. Booke.) But because the readers hereof wil perhaps require of me the demonstration

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of this fundamentall analogie, or proportion of Tangents (hitherto vnknowne) I will here therefore shew the same, so farre forth as the shortnesse of this abridgement will permit.

Let the Sphære therefore A F P G lye vpon the flat superficies H I K Q, that they may touch each other in the common poynt A : from which by the center of the Sphære \odot , let the right line A \odot P be raised, cutting the vpper halfe of the Sphære in the poynt P, and so A \odot P shall bee perpendicular to the plaine or flat H I K Q. Then from the angle A, let be described vpon the superficies of the Sphære, the triangle A $\lambda \gamma$ sharpe angled in γ , or A $\lambda \beta$ blunt angled in β , and the semicircles A λ P, and A γ P, or A β P being drawne forth, taking λ for the pole, according to the distance $\lambda \gamma$, or $\lambda \beta$ which is equall thereto, draw the circle $\alpha \beta \gamma$, cutting λ P in α , and λ A in α , and A $\beta \gamma$ in the poynts β and γ . From the poynt λ to the Arch A $\beta \gamma$ let downe the perpendicular Arch $\lambda \mu$. Here therefore A λ shall be the greater leg, and $\lambda \gamma$ or $\lambda \beta$ the lesse leg, A γ and A β the bases, the one true, the other alterne, A α the difference of the legs, and A μ the summe of the legs, because $\lambda \alpha$ and $\lambda \alpha$ by the construction, are equall to the lesse leg $\lambda \gamma$ or $\lambda \beta$. This being done, and supposing P to be in stead of an eye, or some lightsome body, from the same P to the flat lying vnder H I K Q, let downe the beame P γ , cutting the flat in c , and the beame P β cutting the flat in b : and because $\gamma \beta$ A are in the same plaine or circle with the lightsome body P, their shadows $c b$ A shall be in the same right line.

Likewise



Likewise from the same poynt P to the same plaine, let downe the beame $P a$, cutting the plaine in e , and the beame $P d$ cutting the plaine in d , and because $e \odot A$ are in the same plaine and circle with the lightsome body P : therefore their shadowes $e d A$ shall be in the same streight line. Moreouer, because $P \odot A$ is perpendicular to the plaine, therefore the triangles $P A d$ and $P A e$, and $P A b$ and $P A c$ are right angled in A : and therefore also $A d$ is the Tangent of the angle $AP \eta$ or $AP d$ & $A e$ the tangent of the angle $AP \epsilon$ or $AP e$. So also $A b$ is the tangent of the angle $AP \beta$, or $AP b$ and $A c$ is the Tangent of the angle $AP \gamma$ or $AP c$ supposing PA to be the gnomon or whole sine. And because $A d$ is the Tangent of the angle $AP \eta$, and $AP d$ is the halfe of the angle $A \odot \eta$, (by the 20 Prop. 3. *Eucl.* because this angle is in the center, and that in the circumference) therefore $A d$ is the tangent of halfe the angle $A \odot \eta$, or which is the same of halfe the Arch $A \eta$, which is the halfe difference of the legs. Likewise because $A e$ is the tangent of the angle $AP \epsilon$, and the angle $AP \epsilon$ in the circumference is halfe the angle $A \odot \epsilon$ in the center, therefore $A e$ is the tangent of halfe $A \odot \epsilon$, or of halfe the arch $A \epsilon$, which is the halfe summe of the legs. In like manner in the bases true and alterne, $A b$ shall bee the Tangent of the angle $AP \beta$, or of halfe the angle $A \odot \beta$, or of halfe the arch $A \beta$ which is the one halfe base: and $A c$ shall be the Tangent of the angle $AP \gamma$, or of halfe the angle $A \odot \gamma$, or of halfe the arch $A \gamma$, which is the other halfe base. Now seeing it hath been shewed that $A b$ is the Tangent of one of the halfe

halfe bases, and $A c$ the Tangent of the other halfe base, and that $A d$ is the Tangent of half the difference of the legs, and $A e$ the Tangent of halfe the summe of the legs. I say, that

As $A b$ the Tangent of the true halfe base, is to $A e$ the Tangent of the halfe summe of the legs :

So is $A d$ the tangent of the halfe difference of the legs, to $A c$ the tangent of the alterne halfe base.

Or contrariwise, by making the true base of the alterne.

As $A c$ the tangent of the true halfe base, is to $A e$ the Tangent of the halfe summe of the legs :

So is $A d$ the tangent of the halfe difference of the legs, to $A b$ the tangent of the alterne halfe base.

Which I proue thus : If the poynts $b c d e$ be in the same circle, then as $A b$ is to $A e$, so is $A d$ to $A c$. And contrariwise, as wee said euen now (by 36 Prop. 3 and 16 Prop. 6. Eucl.) But the poynts $b c d e$ fall in the same circle. For the shadow of any circle described in the superficies of a sphere comming from a light some body in the same superficies which is not in the circumference of the circle, maketh a circle perfectly round in the plaine perpendicular to the right line which goeth from the lightsome body by the center of the sphere, as it is manifest out of the Optickes, & making of the *Astrolabe* : and by *Apollonius* in his 1 book of Conick sections prop. 5. But here the circle $A b c d$ is described in the superficies of the Sphere, and the lightsome body P is without the circumference of the circle, and the right line that goeth from the same by the center (that is $P \odot A$ is perpendicular to the plaine) therefore the shadow of that circle which falleth vpon the

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points $d b c e$, is necessarily circular, and perfectly round. Therefore

As $A b$ is to $A e$, so is $A d$ to $A c$.

And contrariwise, that is,

As the tangent of the true halfe base, is to the tangent of the halfe summe of the legs :

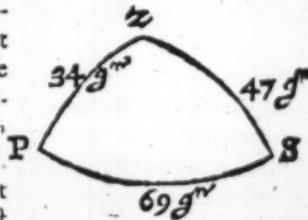
So is the tangent of the halfe difference of the legs, to the tangent of the alterne halfe base. And by consequent, the Differential of the true halfe base, subtracted out of the summe of the Differentials of the halfe summe and halfe difference of the legs, is equall to the Differential of the Alterne halfe base, which things we undertooke to demonstrate.

7 Therefore three sides of a Sphericall triangle being given, any one of the angles is had three wayes.

8 The first way is, That you make any side the base (especially that which commeth neereſt a quadrant) then

Adde halfe the base and halfe the difference of the legs together, and to the Logarithme thereof adde the Logarithme of the difference of them; out of which summe ſubduſt the summe of the Logarithme of the legs: and the halfe of the remainder is the Logarithme of an arch, which being doubled is the verticall angle. And ſo the reſt.

As of the triangle $P Z S$, let the ſides $P Z$ be given 34 deg. and $Z S$ 47 deg. and $S P$ 69 degr. let the angles bee ſought out, and firſt the angle $P Z S$ coming neereſt a quadrant, which



$S P$ 69 deg (that is, the ſide neereſt

a qua-

CHAP. 6. The second Booke. 81

a quadrant) subtendeth. Therefore let this
S P 69 be made the base : then

Add $\frac{1}{2}$ the base, P S — 34 deg. 36

To $\frac{1}{2}$ the difference of
the legs P Z and Z S — } 6 deg. 30

The summe is 41 deg. 6. the Logar. 421504

The differ. is 28 deg. 6. the Logar. 756147

The summe is +1177651

Add the Logar. of the
leg P Z 34 deg. 581260 }
To the Log. of the legg.
Z S 47 deg. +312858 } summe +894118

Subtract the same out
of the former summe, } the rest is 283533

whereof take the halfe +141766

Whch is the Logar. of 60 deg. 12 24 $\frac{1}{2}$
and being doubled is 120 deg. 24 49. the ver-
ticall angle P Z S that was sought for.

No otherwise you may (if you will) finde
out the other angles : but they shall be found
more easily by 9 Chap. 5. of this booke, because
(by 2 Sent. 3 chap.) they are of a certaine and
knowne kinde.

The second way is, that any side (especially that
which is neereſt a quadrant) being made the base,
you add halfe the base, and halfe the summe of
the legs together, and to the Logarithme thereof
add the Logarithme of the difference of them :
out of which summe ſubduct the summe of the Lo-
garithme of the legges, and the halfe of the
remainder is the Antilogarithme of an arch, which
being doubled, is the verticall angle, and ſo the
reſt.

As of the ſame Triangle P Z S

Add halfe the base P S. 34 deg. 36.

E 5

To

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To halfe the sum of the } 40 deg. 30.
legs P Z, and Z S. — }

The summe is 75 deg. 0. the Logar. 2258295

The Differ. is 6 deg. 0 the Logar. 34668

The summe is + 2292963

Adde the Logar. of the
leg. P Z 34 deg. 58 1261 }
To the Log. of the leg } summe is + 894119
Z S. 47 deg. + 312858 } —————

Subtraet the same out } The rest is 1398844
of the former summe, }

whereof take the halfe — + 699422

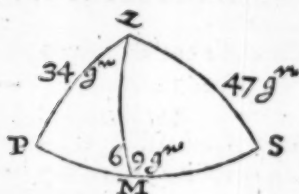
Wh^{ch} is the Antilog. of 60 deg. 12.24 $\frac{1}{2}$
and being donbled is 120 deg. 24.49 the ver-
ticall angle P Z S sought for.

The other angles, although you may finde
after this manner, yet you shall finde them
more easily by 9 Chap 5 of this booke. For by
the second sentence of the third Chap. they
are of a knowne kinde.

- 10 *The third way is, that any side being put for the
base, you add the Differential of halfe the summe
of the legs, to the Differential of halfe the diffe-
rence of the legs, and subtraet from the product
the Differentiaall of the true halfe base, and there
shall come thereof the Differential of the alterne
halfe base. The summe of which halfe bases is the
greater case, and the difference the lesse case, di-
stinguishing two right-angled triangles, which do
make knowne both their owne parts, and all the
parts of the triangle proposed (by 9 chap. 4. and 8
chap. 5. of this booke.)*

As the sides of the triangle propounded
P Z S being giuen, as before, let the angles at
the base Z P S, and Z S P be sought for.

halfe



Half the sum
of the leggs } 40 deg 30. the Differ. 157730
P Z, & Z S is

Half the dif-
ference of } 6 deg. 30. the Differ 217212
them is —

Wch added together, bring forth 2329851

From which subtract
the differ: of halfe } viz. 34. deg. 30. 375012
the true base P Z. —

And there will remaine + 1954839

Which is the Differential of 8 deg 3. 31. halfe
the alterne base.

Adde therefore together the two halfe ba-
ses, to wit,

Halfe the true base 34 deg. 30. 0.
and half the altern base 8 deg. 3. 31.

And they make — 42 deg. 33. 31. the
greater case M S.

Take the one our } rests 26 deg. 26. 29. the
of the other, }
lesse case P M.

Therefore by helpe of these cases, you
haue now two triangles right angled at M,
that is P M Z, and S M Z, which do lay open
both the perpendicular Z M, and the verti-
call angles P Z M and S Z M: or (if you will)
P Z S (by 9 Chap. 4 and 8 Chap. 5 of this book)
But these things being omitted, let vs returne

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to the angles of the base ZPS , ZSP which were sought for.

Add the Differential of the case PM . $26, 26, 29$ already found (by 9 *Self*. 4 *Chap*)

To the Differential of the complement of PZ , which is 56 degrees

There will come forth

Which is the Logarithme of the complement of the angle ZPS , which complement is 47 deg, 30, 1.

Likewise,

Add the Differential of the greater case SM 42 de. 33, 31 already found by the 9 *Self*.

To the Differential of the complement of SZ , which is 43 degrees

There will come forth

Which is the Logarithme of the complement of the angle ZSP , which complement is 58 deg. 53, 55.

But here remember, that not the parts PZ 34, and ZPS , or SZ 47, and ZSP , but their complements, that is, 56 degr. and 47, 30, 1. and 43 deg. and 58 53, 55. are here called circular parts, (by 2 *Chap*. 4. of this booke) Therefore the true angle sought for ZPS , is 42, 29, 59.

And ZSP is 31, 6, 5.

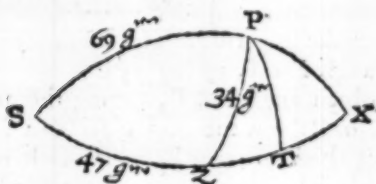
As it also manifest by 8 *Self*. *Chap* 5 of this booke.

Another example of the same triangle.

The same triangle PZS being placed otherwise,

CHAP. 6. The second Booke. 85

therwise, let Z S be the base, and the sides being giuen, as before, let the angle P Z S bee sought for. Therefore.



Halfe the sum
of the legs S P } 51 deg. 30 the Differ- 228865
and P Z is — }
Half the difference of them } 17 dc. 30. the Diff. + 1154234
is — }

Which added together, } — + 925369
bring forth the Differ. }
From which subtract the
Differentiall of halfe } 23 dc. 30 + 832840
the true base S Z, viz. of }

And there will remaine — + 92529
Which is the Differentiall of 42 deg. 21. 11. halfe
the alterne base.

Add therefore together the two halfe bases, to wit,

Halfe the true base 23 deg. 30. 0.
And half the alterne base 42 deg. 21. 11,
And there wil come forth 65 deg. 51. 11, the
greater case S T.
Take the difference of them 18 deg. 51. 11, the
lesse case T X. or T Z.

Add therefore the Differentiall of the same T Z, } — + 1074520
18, 51. 11, viz, — }

To

To the differentia of the
 complement of ZP , which } ————— 393771
 is 56 degrees ————— }

And from thence will arise ———— + 680749
 Which is the Logarithme of the complement
 of the angle PZT . 59 deg 35' 11"

Of which angle PZT , seeing the angle
 sought for PZS is the remainder to a semi-
 circle (which alwayes happeneth when the
 alterne base is greater then the true) the an-
 gle PZS must needs be 120 degrees, 24' 49",
 otherwise if the true base exceed the alterne
 base, the angles PZT , and PZS shall bee
 all one.

As Admonition.

YOU have now three true wayes to finde
 out the angles by the sides giuen, by eue-
 ry one whereof three seuerall questions of
 this and any other triangle are resolued:

For by the eleuation of the pole, the height of
 the Sunne, and declination of the sunne being
 giuen, they that doubt are satisfied concer-
 ning the question: whereby either

- 1 The Azimuth of the Sunne,
- 2 The angle of the situation and position
 of the Sunne: or
- 3 The houre of the day is demanded.

Hitherto wee haue found the angles by the
 sides.

It remaineth to finde the sides by the an-
 gles.

- II In any Sphericall Triangle the sides may bee
 changed into angles, and the angles into sides: yet
 taking first for any one angle and his subtending
 side, the remainders of them to a semicircle.

For

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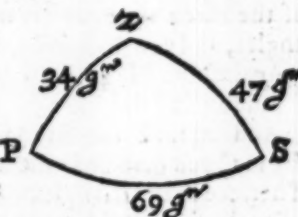
For example sake.

Let QRT be a triangle, whose angles let bee Q 47, R 111, and T 34.

Let vs first take for any angle, as for R 111, his remainder to a semicircle, which is 69 degrees.



I say that these angles 47^d. 69^d. 34^d. may bee changed into sides, & the triangle PZS going afore, and heere now againe expressed shall be made.



Wherein PZ is 34 degrees,

ZS is 47 degrees,

And PS is 69 degrees,

As also of the angles of this repeated triangle shall mutually bee made the sides of the other:

For the angle of this triangle ZSP 31, 6, 5' is the side of the other triangle QR .

And the angle of this ZPS 42, 29, 59' is the side of the other RT .

And of the third angle of this triangle which is SZP 120, 24, 49' the remainder to a semicircle that is 59, 35, 11' is the side QT of the other triangle.

The demonstration whereof *Bartholomew Pitiscus*, *Adrian Metius* and others set downe, therefore I thinke it no need to repeate the same

same in this short Treatise.

- 12 From whence it followeth, that the three angles of a Sphericall triangle being giuen, the sides are found by an easie conuersion.

As in the former triangle QRT , let the angles be giuen $Q 47$, $R 111$, and $T 34$, let the sides be sought.

For any one angle, for example sake, (as before) for $R 111$, let the remainder thereof to a semicircle 69 degrees be taken.

Then $47, 69, 34$ being set for sides (as was done in the former triangle PZS , by any of the three wayes aboue written, seeke his angles, and you shall finde,

Against the side 47 , the angle $42.29.59$.

And against the side 34 the angle $31.6.5$.

And againe the side 69 (which wee put for 111) you shall finde the angle $120.24.49$. Therefore in the triangle propounded, QRT .

For the side RT subtending the angle $Q 47$, set downe $42.29.59$.

And for the side QR subtending the angle $T 34$, set downe $31.6.5$.

But for the side QT subtending the angle $R 111$, set downe $59.35.11$.

Which are the remainder of $120 \text{ deg. } 24' 49''$ to a semicircle, because before you tooke for 111 his remainder to a semicircle, that is 69 . And so by conuersion you shall finde the sides by the angles.

An Admonition.

Of this finding of the sides by the angles giuen, three diuers questions of this and any other triangle whatsoeuer are resolved.

As in the triangle PZS out of the houre of the day, the azimuth of the Sunne, and the angle of

of the site or position of the Sunne, this proposition going before, giueth satisfaction to the question, whereby either

- 1 The height of the pole,
- 2 The height of the Sunne, or
- 3 The declination of the Sunne is demanded.

Therefore (out of the 8 sect. of the former chap. and the 7 & 12 sect. of this booke) you haue the solution of 60 seuerall questions, wch fall into any triangle: neither can there any moe varieties then these arise out of the manifold composition of any three parts.

You haue therefore a perfect & absolute doctrine of triangles, as well Sphericall as Plaine.

THE CONCLUSION.

NOW therefore it hath been sufficiently shewed that there are Logarithmes, what they are, and of what use they are: for with helpe of them we haue both demonstratiuely shewed and taught by examples of both kindes of Trigonometrie, that the Arithmetickall solution of any Geometrickall question may most readily bee performed without trouble of Multiplication, Diuision, or extraction of roots. You haue therefore the admirable Table of Logarithmes that was promised, together with the most plentifull use thereof, which if (to you of the learmed sort) I shall by your letters understand to be acceptable to you, I shall be encouraged to set forth also the way to make the Table. In the meane time, make use of this short Treatise, and giue all praise and glory to God the high Inuenter and guider of all good workes.

The end of the Treatise.

Now followeth the Table or Canon of
Logarithmes.

Deg. 0 $+|-$

mi	Sines	Logarith.	Differen.	Logarith.	Sines
0	0	Infinite.	Infinite.	.0	1000000.0
1	291	8142567	8142568	.1	1000000.0
2	582	7449419	7449421	.2	999999.8
3	873	7043952	7043956	.4	999999.6
4	1164	6756275	6756274	.7	999999.3
5	1454	6533131	6533130	1.1	999998.9
6	1745	6350810	6350808	1.6	999998.6
7	2036	6196659	6196657	2.2	999998.0
8	2327	6063128	6063126	2.8	999997.4
9	2618	5945345	5945342	3.5	999996.7
10	2909	5839986	5839981	4.3	999995.9
11	3200	5744676	5744671	5.2	999995.0
12	3491	5657665	5657658	6.2	999994.0
13	3781	5577622	5577615	7.3	999992.8
14	4072	5513514	5503506	8.4	999991.7
15	4363	5434522	5434513	9.6	999990.5
16	4654	5369984	5369973	10.9	999989.2
17	4945	5309360	5309348	12.3	999987.8
18	5236	5252202	5252188	13.8	999986.3
19	5527	5198136	5198120	15.4	999984.7
20	5818	5146843	5146836	17.0	999983.1
21	6109	5098054	5098045	18.7	999981.3
22	6399	5051534	5051514	20.5	999979.5
23	6690	5007083	5007060	22.4	999977.6
24	6981	4964524	4964499	24.4	999975.6
25	7272	4923703	4923676	26.5	999973.6
26	7563	4884183	4884154	28.7	999971.4
27	7854	4846743	4846712	30.9	999969.2
28	8145	4810376	4810343	33.2	999966.8
29	8436	4775286	4775250	35.5	999964.4
30	8726	4741385	4741347	38.1	999961.9

Min.

Deg. 89

Deg. 0

+ -

mi	Sines	Logarith.	Differen.	Logarith.	Sines	
30	8726	4741385	4741347	38.1	999961.9	30
31	9017	4708596	4708553	40.7	999959.3	29
32	9308	4676848	4676805	43.4	999956.6	28
33	9599	4646077	4646031	46.1	999953.9	27
34	9890	4616225	4616176	48.9	999951.1	26
35	10181	4587239	4587187	51.8	999948.2	25
36	10472	4559069	4559014	54.8	999945.2	24
37	10763	4531671	4531613	57.9	999942.1	23
38	11054	4505004	4504943	61.1	999938.9	22
39	11344	4479030	4478965	64.4	999935.7	21
40	11635	4453713	4453645	67.7	999932.3	20
41	11926	4429022	4428950	71.1	999928.9	19
42	12217	4404925	4404850	74.6	999925.4	18
43	12508	4381396	4381318	78.2	999921.8	17
44	12799	4358408	4358326	81.9	999918.1	16
45	13090	4335936	4335850	85.7	999914.3	15
46	13380	4313958	4313868	89.6	999910.5	14
47	13671	4292453	4292360	93.5	999906.5	13
48	13962	4271401	4271304	97.5	999902.5	12
49	14253	4250783	4250682	101.6	999898.4	11
50	14544	4230583	4230477	105.8	999894.2	10
51	14835	4210781	4210671	110.1	999890.0	9
52	15126	4191364	4191250	114.5	999885.6	8
53	15416	4172317	4172198	118.9	999881.1	7
54	15707	4153627	4153504	123.4	999876.6	6
55	15998	4135279	4135151	128.0	999872.0	5
56	16289	4117263	4117130	132.7	999867.3	4
57	16580	4100664	4100527	137.5	999862.5	3
58	16871	4082175	4082032	142.4	999857.7	2
59	17162	4065082	4064935	147.3	999852.7	1
60	17452	4048276	4048124	152.3	999847.7	0

Min.

Deg. 89

Deg. 1 + | —

m.	Sines.	Logarith.	Differen.	Logarit.	Sines.
0	17452	4048276	4048124	152	9998486
1	17743	4031748	4031591	157	9998435
2	18034	4015490	4015327	162	9998375
3	18325	3999492	3999324	168	9998315
4	18615	3983745	3983571	173	9998256
5	18907	3968242	3968063	179	9998195
6	19197	3952976	3952792	184	9998135
7	19488	3937941	3937751	190	9998075
8	19779	3923127	3922932	196	9998015
9	20070	3908531	3908329	201	9997955
10	20361	2894144	3893937	207	9997895
11	20652	3879961	3879748	213	9997835
12	20942	3865977	3865757	219	9997775
13	21233	3852186	3851960	225	9997714
14	21524	3838582	3838351	232	9997654
15	21815	3825161	3824923	238	9997594
16	22106	3811918	3811674	244	9997534
17	22396	3798848	3798597	251	9997474
18	22687	3785947	3785690	257	9997414
19	22978	3773210	3772946	264	9997354
20	23269	3760634	3760363	271	9997294
21	23568	3748213	3747936	278	9997234
22	23850	3735946	3735661	284	9997174
23	24141	3723827	3723535	291	9997114
24	24432	3711853	3711555	299	9997054
25	24723	3700021	3699715	306	9996994
26	25014	3688327	3688014	313	9996934
27	25304	3676769	3676449	320	9996874
28	25595	3665343	3665015	328	9996814
29	25886	3654045	3653710	335	9996754
30	26177	3642875	3642532	343	9996694

M.D.

Deg. 88

Deg. 2 + | —

m.	Sines	Logarith.	Differen.	Logarit.	Sines
30	43619	3132252	3131300	952	99904830
31	43910	3125612	3124647	965	99903529
32	44201	3119016	3118038	978	99902328
33	44491	3112463	3111472	991	99901027
34	44782	3105952	3104948	1004	99899726
35	45072	3099484	3098467	1017	99898425
36	45363	3093058	3092028	1030	99897124
37	45654	3086672	3085629	1043	99895823
38	45944	3080328	3079271	1056	99894522
39	46235	3074023	3072953	1070	99893221
40	46525	3067758	3066674	1083	99891920
41	46816	3061532	3060435	1097	99890619
42	47106	3055344	3054233	1111	99889318
43	47397	3049195	3048070	1124	99888017
44	47688	3043083	3041945	1138	99886716
45	47978	3037009	3035857	1152	99885415
46	48269	3030971	3029805	1166	99884114
47	48559	3024970	3023790	1180	99882813
48	48850	3019005	3017810	1194	99881512
49	49141	3013075	301186	1209	99880211
50	49431	3007180	3005950	1223	99878910
51	49721	3001319	3000082	1238	99877609
52	50012	2995493	2994241	1252	99876308
53	50302	2989701	2988435	1267	99875007
54	50593	2983942	2982661	1281	99873706
55	50883	2978216	2976920	1296	99872405
56	51174	2972524	2971212	1311	99871104
57	51464	2966863	2965537	1326	99869803
58	51755	2961233	2959892	1341	99868502
59	52045	2955636	2954280	1356	99867201
60	52336	2950071	2948699	1372	99865900

Min

Deg. 87

Deg. 3

11

mi.	Sines	Logarithb.	Differen.	Logarit.	Sines	mi.
0	51336	2950071	2948699	1371	99861960	30
1	51626	2944535	2943149	1387	99861459	31
2	51917	2939030	2937629	1402	99859958	32
3	53207	2933556	2932139	1418	99858357	33
4	53498	2928112	2926671	1433	99856856	34
5	53788	2922697	2921249	1449	99855255	35
6	54079	2917311	2915847	1464	99853754	36
7	54369	2911954	2910475	1480	99852153	37
8	54660	2906627	2905131	1496	99850552	38
9	54950	2901327	2899815	1512	99848951	39
10	55241	2896056	2894528	1528	99847350	40
11	55531	2890812	2889267	1544	99845749	41
12	55822	2885595	2884035	1560	99844148	42
13	56112	2880406	2878829	1577	99842447	43
14	56402	2875243	2873650	1593	99840846	44
15	56693	2870107	2868497	1610	99839245	45
16	56983	2864997	2863371	1626	99837644	46
17	57274	2859914	2858271	1643	99835943	47
18	57564	2854857	2853198	1659	99834242	48
19	57854	2849825	2848148	1676	99832541	49
20	58145	2844818	2843125	1693	99830840	50
21	58435	2839835	2838125	1710	99829139	51
22	58726	2834878	2833151	1727	99827438	52
23	59016	2829946	2828201	1744	99825737	53
24	59306	2825038	2823276	1762	99824036	54
25	59597	2820153	2818375	1779	99822235	55
26	59887	2815293	2813497	1796	99820534	56
27	60177	2810456	2808642	1814	99818833	57
28	60468	2805643	2803811	1831	99817032	58
29	60758	2800852	2799003	1849	99815231	59
30	61048	2796085	2794218	1867	99813530	60

Min.

Deg. 86

Deg. 3 + —

m.	Sines.	Logarith	Differen.	Logarit.	Sines.
30	61048	2796085	2794218	1867	998135
31	61339	2791340	2789455	1885	998117
32	61629	2786618	2784715	1903	998099
33	61920	2781918	2779998	1921	998081
34	62210	2777241	2775302	1939	998063
35	62500	2772585	2770628	1957	998045
36	62790	2767950	2765975	1975	998027
37	63081	2763337	2761344	1993	998008
38	63371	2758746	2756734	2012	997990
39	63661	2754175	2752145	2030	997972
40	63952	2749626	2747577	2049	997953
41	64242	2745097	2743029	2068	997934
42	64532	2740588	2738502	2086	997916
43	64823	2736100	2733995	2105	997897
44	65113	2731632	2729508	2124	997878
45	65403	2727184	2725041	2143	997859
46	65693	2722756	2720594	2162	997840
47	65984	2718348	2716166	2181	997821
48	66274	2713958	2711757	2201	997801
49	66564	2709588	2707368	2220	997782
50	66854	2705237	2702998	2240	997763
51	67145	2700906	2698646	2259	997743
52	67435	2696592	2694314	2279	997724
53	67725	2692298	2689999	2298	997704
54	68015	2688022	2685703	2318	997684
55	68305	2683764	2681426	2338	997664
56	68596	2679524	2677166	2358	997645
57	68886	2675303	2672924	2378	997625
58	69176	2671098	2668700	2398	997604
59	69466	2666913	2664494	2419	997584
60	69756	2662744	2660305	2439	997564

Min

F

Deg. 86

Deg. 4 + —

m.	Sines	Logarith.	Differen.	Logarit.	Sines
0	69756	2662744	2660305	2439	99756460
1	70047	2658593	2656133	2459	99754459
2	70337	2654459	2651979	2480	99752358
3	70627	2650342	2647841	2500	99750357
4	70917	2646242	2643721	2521	99748256
5	71207	2642159	2639617	2542	99746155
6	71497	2638093	2635530	2563	99744154
7	71788	2634043	2631459	2583	99742053
8	72078	2630009	2627405	2604	99739952
9	72368	2625992	2623367	2625	99737851
10	72658	2621991	2619345	646	99735750
11	72948	2618007	2615339	668	99733649
12	73238	2614038	2611349	2689	99731448
13	73528	2610084	2607373	2710	99729347
14	73818	2606146	2603415	2732	99727246
15	74108	2602224	2599471	2753	99725045
16	74398	2598318	2595542	2775	99722944
17	74689	2594426	2591629	2797	99720743
18	74979	2590550	2587731	2819	99718542
19	75269	2586688	2583848	2841	99716341
20	75559	2582842	2579980	2863	99714140
21	75849	2579011	2575126	2885	99711939
22	76139	2575194	2571287	2907	99709738
23	76429	2571392	2567473	2929	99707537
24	76718	2567604	2563653	2952	99705336
25	77009	2563831	2560857	2974	99703035
26	77299	2560072	2557076	2996	99700834
27	77589	2556327	2553308	3019	99698533
28	77879	2552597	2549555	3042	99696332
29	78169	2548880	2545815	3065	99694031
30	78459	2545177	2542089	3087	99691729

Min.

Deg. 85

Deg. 4 + | -

m.	Sines	Logarith.	Differen.	Logarit.	Sines	
30	78459	2545177	2542089	3087	996917	30
31	78749	2541488	2538377	3110	996894	29
32	79039	2537812	2534678	3133	996871	28
33	79329	2534150	2530993	3156	996848	27
34	79619	2530501	2527322	3180	996825	26
35	79909	2526866	2523663	3203	996802	25
36	80199	2523244	2520018	3226	996779	24
37	80489	2519635	2516386	3250	996755	23
38	80779	2516040	2512767	3273	996732	22
39	81069	2512457	2509160	3297	996708	21
40	81359	2508887	2505566	3321	996685	20
41	81649	2505330	2501985	3344	996661	19
42	81938	2501785	2498417	3368	996637	18
43	82228	2498253	2494861	3392	996613	17
44	82518	2494734	2491318	3416	996589	16
45	82808	2491227	2487787	3440	996565	15
46	83098	2487733	2484268	3465	996541	14
47	83388	2484250	2480761	3489	996517	13
48	83678	2480780	2477267	3513	996493	12
49	83968	2477322	2473784	3537	996468	11
50	84257	2473866	2470314	3562	996444	10
51	84547	2470442	2466855	3587	996419	9
52	84837	2467020	2463408	3612	996395	8
53	85127	2463609	2459973	3636	996370	7
54	85417	2460210	2456549	3661	996345	6
55	85707	2456823	2453136	3686	996320	5
56	85996	2453447	2449736	3711	996295	4
57	86286	2450083	2446346	3737	996270	3
58	86576	2446730	2442968	3762	996245	2
59	86866	2443388	2439601	3787	996220	1
60	87156	2440058	2436245	3813	996195	0

Mm.

Deg. 5 +

m.	Sines.	Logarith.	Differen.	Logarit.	Sines.
0	87156	2440058	2436245	3813	99619560
1	87445	2436738	2432900	3838	99616959
2	87735	2433430	2429566	3864	99614458
3	88025	2430133	2426243	3889	99611857
4	88315	2426847	2422932	3915	99609356
5	88604	2423571	2419630	3941	99606755
6	88894	2420306	2416340	3967	99604154
7	89184	2417052	2413059	3993	99601553
8	89474	2413809	2409790	4019	99598952
9	89763	2410576	2406531	4045	99596351
10	90053	2407354	2403282	4071	99593750
11	90343	2404142	2400045	4098	99591049
12	90632	2400941	2396817	4124	99588448
13	90922	2397749	2393599	4150	99585847
14	91212	2394568	2390391	4177	99583246
15	91502	2391398	2387194	4204	99580645
16	91791	2388237	2384007	4230	99577844
17	92081	2385087	2380829	4257	99575143
18	92371	2381946	2377661	4284	99572442
19	92660	2378815	2374504	4311	99569741
20	92950	2375694	2371356	4339	99567040
21	93239	2372583	2368217	4365	99564439
22	93529	2369482	2365089	4393	99561838
23	93819	2366390	2361969	4420	99559237
24	94108	2363308	2358860	4448	99556636
25	94398	2360235	2355760	4475	99554035
26	94687	2357172	2352669	4503	99551434
27	94977	2354119	2349588	4531	99548833
28	95267	2351075	2346516	4558	99546232
29	95556	2348040	2343453	4586	99543631
30	95846	2345014	2340400	4614	99541030

Min.

Deg. 84

Deg. 5

+|-

m	Sines	Logarith.	Differen.	Logarit.	Sines
30	95846	2345014	2340400	4614	99539630
31	96135	2341998	2337356	4642	99536829
32	96425	2338991	2334320	4670	99534028
33	96714	2335993	2331294	4699	99531227
34	97004	2333004	2328277	4727	99528426
35	97293	2330023	2325268	4755	99525625
36	97583	2327052	2322269	4784	99522724
37	97872	2324090	2319278	4812	99519923
38	98162	2321137	2316296	4841	99517022
39	98451	2318192	2313322	4870	99514221
40	98741	2315256	2310357	4899	99511320
41	99030	2312220	2307401	4928	99508419
42	99320	2309410	2304453	4957	99505618
43	99609	2306500	2301514	4986	99502717
44	99899	2303598	2298584	5015	99499816
45	100188	2300706	2295661	5044	99496815
46	100477	2297821	2292748	5073	99493914
47	100767	2294945	2289842	5103	99491013
48	101056	2292077	2286945	5132	99488112
49	101346	2289217	2284055	5162	99485111
50	101635	2286366	2281174	5192	99482210
51	101924	2283523	2278301	5221	9947929
52	102214	2280688	2275437	5251	9947628
53	102503	2277861	2272580	5281	9947337
54	102793	2275042	2269731	5311	9947036
55	103082	2272231	2266890	5341	9946735
56	103371	2269428	2264057	5371	9946434
57	103661	2266633	2261232	5402	9946133
58	103950	2263846	2258414	5432	9945832
59	104239	2261066	2255604	5463	9945531
60	104528	2258295	2252802	5493	9945230

M. 17.

F 3

Deg. 84

Deg. 6

+1-

m.	Sines	Logarith.	Differen.	Logarit.	Sines
0	104528	2258295	2252802	5493	99452260
1	104818	2255531	2250007	5524	99449159
2	105107	2252775	2247221	5554	99446158
3	105396	2250027	2244441	5585	99443057
4	105686	2247286	2241670	5616	99440056
5	105975	2244553	2238905	5647	99436955
6	106264	2241827	2236149	5678	99433854
7	106553	2239109	2233400	5709	99430743
8	106843	2236398	2230658	5740	99427652
9	107132	2233695	2227923	5772	99424551
10	107421	2230999	2225196	5803	99421450
11	107710	2228310	2222476	5835	99418249
12	107999	2225629	2219763	5866	99415148
13	108289	2222954	2217057	5898	99411947
14	108578	2220288	2214358	5930	99408846
15	108867	2217628	2211667	5961	99405645
16	109156	2214976	2208983	5993	99402544
17	109445	2212331	2206305	6025	99399343
18	109734	2209692	2203635	6057	99396142
19	110023	2207061	2200972	6089	99392941
20	110313	2204437	2198315	6122	99389740
21	110602	2201819	2195665	6154	99386539
22	110891	2199209	2193023	6186	99383338
23	111180	2196605	2190386	6219	99380037
24	111469	2194009	2187757	6251	99376836
25	111758	2191419	2185134	6284	99373535
26	112047	2188835	2182518	6317	99370334
27	112336	2186259	2179909	6350	99367033
28	112625	2183689	2177306	6383	99363832
29	112914	2181126	2174710	6416	99360531
30	113203	2178570	2172121	6449	99357230

Min.

Deg. 83

Deg. 6

+|-

m.	Sines	Logarith.	Differen.	Logarit.	Sines	
30	113203	2178570	2172121	6449	993572	30
31	113492	2176020	2169538	6482	993539	29
32	113781	2173477	2166961	6515	993506	28
33	114070	2170940	2164392	6549	993473	27
34	114359	2168410	2161828	6582	993439	26
35	114648	2165886	2159270	6616	993406	25
36	114937	2163369	2156720	6649	993373	24
37	115226	2160859	2154176	6683	993339	23
38	115515	2158354	2151637	6717	993306	22
39	115804	2155856	2149105	6751	993272	21
40	116093	2153364	2146579	6785	993238	20
41	116382	2150878	2144059	6819	993205	19
42	116671	2148399	2141546	6853	993171	18
43	116960	2145925	2139038	6887	993137	17
44	117248	2143458	2136537	6921	993103	16
45	117537	2140998	2134042	6956	993068	15
46	117826	2138543	2131553	6990	993034	14
47	118115	2136095	2129070	7025	993000	13
48	118404	2133652	2126593	7059	992966	12
49	118693	2131216	2124122	7094	992931	11
50	118982	2128785	2121657	7129	992896	10
51	119270	2126361	2119197	7164	992862	9
52	119559	2123942	2116744	7199	992827	8
53	119848	2121530	2114296	7234	992792	7
54	120137	2119123	2111854	7269	992757	6
55	120425	2116722	2109418	7304	992722	5
56	120714	2114327	2106988	7340	992687	4
57	121003	2111938	2104563	7375	992652	3
58	121292	2109555	2102144	7410	992617	2
59	121580	2107177	2099731	7446	992582	1
60	121869	2104805	2097323	7482	992546	0

Min.

Deg. 7



m.	Sines	Logarith.	Differen.	Logarit	Sines
0	121869	2104805	2097323	7482	99254660
1	122158	2102438	2094921	7518	99251159
2	122447	2100078	2092524	7553	99247558
3	122735	2097723	2090134	7589	99243957
4	123024	2095374	2087748	7625	99240456
5	123313	2093030	2085369	7661	99236855
6	123601	2090692	2082995	7698	99233254
7	123890	2088359	2080626	7734	99229643
8	124179	2086032	2078261	7770	99226052
9	124467	2083711	2075904	7807	99222451
10	124756	2081394	2073551	7843	99218850
11	125044	2079084	2071204	7880	99215249
12	125333	2076778	2068862	7917	99211648
13	125622	2074478	2066525	7953	99208047
14	125910	2072184	2064193	7990	99204446
15	126199	2069895	2061867	8027	99200845
16	126488	2067611	2059546	8064	99197244
17	126776	2065332	2057231	8101	99193643
18	127065	2063059	2054920	8138	99189942
19	127353	2060791	2052615	8176	99186341
20	127642	2058528	2050315	8213	99182740
21	127930	2056270	2048019	8251	99179139
22	128219	2054018	2045729	8288	99175538
23	128507	2051770	2043444	8326	99171937
24	128796	2049528	2041164	8364	99168336
25	129084	2047291	2038889	8401	99164735
26	129373	2045059	2036619	8439	99161134
27	129661	2042832	2034354	8477	99157533
28	129949	2040610	2032094	8515	99153932
29	130238	2038392	2029839	8554	99150331
30	130526	2036180	2027589	8592	99146730

Min.

Deg. 82

Deg. 7

+ | —

mi	Sines	Logarith	Differen	Logarit	Sines	
30	130526	2036180	2027549	8592	991445	30
31	130815	2033974	2025343	8630	991407	29
32	131103	2031772	2023103	8669	991369	28
33	131391	2029575	2020867	8707	991331	27
34	131680	2027382	2018636	8746	991292	26
35	131968	2025195	2016410	8784	991254	25
36	132256	2023012	2014189	8823	991216	24
37	132545	2020834	2011972	8862	991177	23
38	132833	2018661	2009760	8901	991138	22
39	133121	2016493	2007553	8940	991100	21
40	133410	2014330	2005351	8979	991061	20
41	133698	2012172	2003153	9018	991022	19
42	133986	2010018	2000960	9058	990983	18
43	134274	2007869	1998772	9097	990944	17
44	134563	2005724	1996588	9136	990905	16
45	134851	2003585	1994409	9176	990866	15
46	135139	2001449	992234	9216	990827	14
47	135427	1999319	990063	9255	990787	13
48	135716	1997193	1987898	9295	990748	12
49	136004	1995072	1985737	9335	990708	11
50	136292	1992955	1983580	9375	990669	10
51	136580	1990843	1981428	9415	990629	9
52	136868	1988736	1979280	9455	990589	8
53	137156	1986633	1977137	9495	990549	7
54	137445	1984534	1974998	9536	990509	6
55	137733	1982440	1972864	9576	990469	5
56	138021	1980350	1970734	9617	990429	4
57	138309	1978265	1968608	9657	990389	3
58	138597	1976184	1966486	9698	990349	2
59	128885	1974108	1964369	9739	990308	1
60	139173	1972036	1962257	9780	990268	0

Min

F 5

Deg. 82

Deg. 8

+—

m.	Sines	Logarith.	Differen.	Logarit.	Sines
0	139173	1972036	1962257	9780	99016860
1	139461	1969969	1960148	9820	99012859
2	139749	1967905	1958044	9861	99018758
3	140037	1965846	1955944	9903	99014657
4	140325	1963792	1953848	9944	99010556
5	140613	1961741	1951756	9985	99006555
6	140901	1959695	1949669	10026	99002454
7	141189	1957653	1947586	10068	98998353
8	141477	1955616	1945507	10109	98994252
9	141765	1953583	1943432	10151	98990051
10	142053	1951554	1941361	10193	98985950
11	142341	1949530	1939294	10234	98981849
12	142629	1947508	1937232	10276	98977648
13	142916	1945492	1935173	10318	98973547
14	143205	1943479	1933119	10360	98969346
15	143493	1941471	1931069	10402	98965145
16	143780	1939467	1929022	10445	98961044
17	144068	1937467	1926980	10487	98956843
18	144356	1935471	1924941	10529	98952642
19	144644	1933479	1922907	10572	98948441
20	144932	1931491	1920876	10614	98944240
21	145220	1929507	1918850	10657	98939939
22	145507	1927527	1916828	10700	98935738
23	145795	1925552	1914809	10743	98931537
24	146083	1923580	1912794	10785	98927236
25	146371	1921612	1910783	10828	98923035
26	146659	1919648	1908776	10872	98918734
27	146946	1917687	1906773	10915	98914433
28	147234	1915731	1904773	10958	98910232
29	147522	1913779	1902778	11001	98905931
30	147809	1911831	1900786	11045	98901630

Min.

Deg. 81

Deg. 8

+|-

mi	Sines	Logarith.	Differen.	Logarit.	Sines.	
30	147809	1911831	1900786	11045	988016	30
31	148097	1909886	1898798	11088	988973	29
32	148385	1907946	1896814	11132	988930	28
33	148672	1906009	1890833	11176	988887	27
34	148960	1904076	1892857	11219	988843	26
35	149248	1902147	1890883	11263	988800	25
36	149535	1900221	1888914	11307	988756	24
37	149822	1898300	1886948	11351	988713	23
38	150110	1896382	1884987	11395	988669	22
39	150398	1894468	1883028	11440	988625	21
40	150686	1892558	1881074	11484	988582	20
41	150973	1890652	1879123	11528	988538	19
42	151261	1888749	1877176	11573	988494	18
43	151548	1886850	1875232	11617	988450	17
44	151836	1884954	1873292	11662	988406	16
45	152123	1883062	1871356	11707	988361	15
46	152411	1881174	1869423	11752	988317	14
47	152698	1879290	1867493	11797	988273	13
48	152986	1877409	1865567	11842	988228	12
49	153273	1875532	1863645	11887	988184	11
50	153561	1873658	1861726	11932	988139	10
51	153848	1871788	1859811	11977	988094	9
52	154136	1869922	1857899	12022	988050	8
53	154423	1868059	1855991	12068	988005	7
54	154710	1866199	1854086	12113	987960	6
55	154998	1864344	1852185	12159	987915	5
56	155285	1862491	1850287	12204	987870	4
57	155572	1860643	1848392	12250	987824	3
58	155860	1858797	1846501	12296	987779	2
59	156147	1856956	1844614	12342	987734	1
60	156434	1855117	1842729	12388	987688	0

Min.

Deg. 81

Deg. 9



m.	Sines	Logarith	Differen.	Logarit.	Sines	m.
0	156434	1855117	1842729	12388	98768860	30
1	15672	1853283	1840848	12434	98764359	31
2	157009	1851451	1838971	12480	98759758	32
3	157296	1849623	1837096	12527	98755157	33
4	157584	1847798	1835225	12573	98750656	34
5	157870	1845977	1833358	12620	98746055	35
6	158158	1844159	1831493	12666	98741454	36
7	158445	1842345	1829632	12713	98736853	37
8	158732	1840534	1827775	12759	98732252	38
9	159020	1838726	1825920	12806	98727651	39
10	159307	1836922	1824069	12853	98723050	40
11	159594	1835121	1822221	12900	98718449	41
12	159881	1833324	1820376	12947	98713848	42
13	160168	1831526	1818535	12994	98709247	43
14	160455	1829738	1816697	13041	98704646	44
15	160743	1827951	1814862	13089	98699945	45
16	161030	1826166	1813030	13136	98695344	46
17	161317	1824385	1811201	13184	98690743	47
18	161604	1822607	1809376	13231	98686142	48
19	161891	1820832	1807553	13279	98681541	49
20	162178	1819061	1805734	13327	98676940	50
21	162465	1817292	1803918	13375	98672339	51
22	162752	1815527	1802104	13423	98667738	52
23	163039	1813765	1800295	13471	98663137	53
24	163326	1812007	1798488	13519	98658536	54
25	163613	1810251	1796684	13567	98653935	55
26	163900	1808499	1794883	13615	98649334	56
27	164187	1806749	1793086	13664	98644733	57
28	164474	1805003	1791291	13712	98640132	58
29	164761	1803260	1789500	13761	98635531	59
30	165048	1801521	1787711	13809	98630930	60

Min.

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Deg. 9 +1—

ms	Sines	Logarith.	Differen.	Logarit.	Sines.	
30	165048	1801521	1787711	13809	986186	30
31	165334	1799784	1785926	13858	986238	29
32	165621	1798050	1784143	13907	986189	28
33	165905	1796329	1782364	13956	986141	27
34	166195	1794592	1780587	14005	986093	26
35	166432	1792868	1778814	14054	986045	25
36	166769	1791146	1777043	14103	985996	24
37	167055	1789428	1775276	14152	985947	23
38	167342	1787713	1773511	14201	985899	22
39	167629	1786001	1771750	14251	985850	21
40	167916	1784291	1769991	14300	985801	20
41	168203	1782585	1768235	14350	985752	19
42	168489	1780882	1766482	14400	985703	18
43	168776	1779182	1764732	14449	985654	17
44	169063	1777484	1762985	14499	985605	16
45	169349	1775790	1761241	14549	985556	15
46	169636	1774098	1759499	14599	985507	14
47	169923	1772410	1757761	14649	985457	13
48	170209	1770724	1756025	14700	985408	12
49	170496	1769042	1754292	14750	985358	11
50	170783	1767362	1752562	14800	985309	10
51	171069	1765686	1750835	14851	985259	9
52	171356	1764012	1749111	14901	985209	8
53	171643	1762341	1747389	14952	985159	7
54	171929	1760673	1745670	15002	985109	6
55	172216	1759007	1743954	15053	985059	5
56	172502	1757345	1742241	15104	985009	4
57	172789	1755685	1740530	15155	984959	3
58	173075	1754028	1738822	15206	984909	2
59	173362	1752374	1737117	15257	984858	1
60	173648	1750723	1735415	15309	984808	0

Min.

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Deg. 10 +1

	Sines	Logarith.	Differen.	Logarit.	Sines.	m.
0	173648	1750723	1735415	15309	984808	60
1	173935	1749075	1733715	15360	984757	59
2	174221	1747430	1732018	15411	984707	58
3	174507	1745787	1730324	15463	984656	57
4	174794	1744147	1728632	15515	984605	56
5	175080	1742519	1726943	15566	984554	55
6	175367	1740875	1925257	15618	984503	54
7	175653	1739244	1723574	15670	984452	53
8	175939	1737615	1721893	15722	984401	52
9	176226	1735989	1720215	15774	984350	51
10	176512	1734365	1718539	15826	984298	50
11	176798	1732744	1716866	15878	984247	49
12	177085	1731126	1715196	15931	984196	48
13	177371	1729511	1713528	15983	984144	47
14	177657	1727898	1711863	16035	984092	46
15	177943	1726288	1710200	16088	984041	45
16	178230	1724681	1708540	16141	983989	44
17	178516	1723076	1706883	16193	983937	43
18	178802	1721474	1705228	16246	983885	42
19	179088	1719875	1703576	16299	983833	41
20	179375	1718278	1701926	16352	983781	40
21	179661	1716684	1700279	16405	983729	39
22	179947	1715093	1698634	16458	983676	38
23	180233	1713504	1696992	16512	983624	37
24	180519	1711918	1695353	16565	983571	36
25	180805	1710334	1693716	16618	983519	35
26	181091	1708753	1692081	16672	983466	34
27	181377	1707175	1690449	16725	983414	33
28	181663	1705599	1688819	16779	983360	32
29	181949	1704025	1687192	16833	983308	31
30	182235	1702454	1685568	16887	983255	30

Min.

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Deg. 10 $+|-$

m.	Sines	Logarith.	Differen.	Logarit.	Sines.
60	30 182235	1702455	1685568	16887	983255 30
59	31 182521	1700887	1683946	16941	983202 19
58	32 182807	1699321	1682326	16994	983149 28
57	33 183093	1697758	1680709	17049	983096 27
56	34 183379	1696197	1679094	17103	983042 26
55	35 183665	1694639	1677482	17157	982989 25
54	36 183951	1693084	1675872	17212	982935 24
53	37 184237	1691530	1674264	17266	982882 23
52	38 184523	1689980	1672659	17321	982828 22
51	39 184809	1688432	1671056	17376	982774 21
50	40 185095	1686886	1669456	17430	982721 10
49	41 185381	1685343	1667858	17485	982667 19
48	42 185667	1683802	1666262	17540	982613 18
47	43 185952	1682264	1664669	17595	982559 17
46	44 186238	1680728	1663078	17650	982505 16
45	45 186524	1679195	1661489	17705	982450 15
44	46 186810	1677664	1659903	17761	982396 14
43	47 187096	1676135	1658319	17816	982342 13
42	48 187381	1674609	1656737	17871	982287 12
41	49 187667	1673085	1655158	17927	982233 11
40	50 187953	1671564	1653581	17983	982178 10
39	51 188238	1670045	1652007	18038	982123 9
38	52 188524	1668529	1650434	18094	982069 8
37	53 188810	1667014	1648864	18150	982014 7
36	54 189095	1665503	1647297	18206	981959 6
35	55 189381	1663993	1645731	18262	981904 5
34	56 189667	1662486	1644168	18318	981849 4
33	57 189952	1660982	1642607	18374	981793 3
32	58 190238	1659479	1641049	18431	981738 2
31	59 190523	1657979	1639492	18487	981683 1
30	60 190809	1656482	1637938	18544	981627

Min.

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+1—

m	Sines	Logarith	Differen.	Logarit	Sines.	
0	190809	165648	1637938	18544	981627	60
1	191094	1654986	1636386	18600	981572	59
2	191380	1653493	1634836	18657	981516	58
3	191665	1652003	1633289	18714	981460	57
4	191951	1650514	1631744	18770	981404	56
5	192236	1649028	1630201	18827	981349	55
6	192522	1647544	1628663	18884	981293	54
7	192807	1646063	1627121	18942	981237	53
8	193093	164458	1625585	18999	981181	52
9	193378	1643107	1624051	19056	981124	51
10	193664	1641632	1622518	19113	981068	50
11	193949	1640160	1620989	19171	981012	49
12	194234	1638689	1619461	19228	980955	48
13	194520	1637222	1617935	19286	980899	47
14	194805	1635756	1616412	19344	980842	46
15	195090	1634292	1614891	19402	980785	45
16	195376	1632831	1613372	19459	980728	44
17	195661	1631372	1611854	19517	980672	43
18	165946	1629915	1610339	16576	980615	42
19	196231	1628460	1608827	19634	980558	41
20	196517	1627008	1607316	19692	980501	40
21	196802	1625555	1605807	19750	980443	39
22	197087	1624109	1604301	19809	980386	38
23	197372	1622664	1602796	19867	980329	37
24	197657	1601220	1601294	19926	980271	36
25	197942	1619778	1599794	19984	980214	35
26	198228	1618339	1598295	20043	980156	34
27	198513	1616902	1596799	20102	980098	33
28	198798	1615466	1595305	20161	980041	32
29	199083	1614034	1593813	20220	979983	31
30	199368	1612603	1592323	20279	979925	30

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Deg. II +1-

m	Sines.	Logarith	Differen.	Logarit.	Sines.
30	199368	1612603	1592323	20279	979925
31	199653	1611174	1590835	20339	979867
32	199938	1609748	1589350	20398	979809
33	200223	1608323	1587866	20457	979750
34	200508	1606901	1586384	20517	979692
35	200793	1605481	1584904	20576	979634
36	201078	1604062	1583426	20636	979575
37	201363	1602646	1581950	20696	979517
38	201648	1601232	1580476	20756	979458
39	201933	1599820	1579005	20816	979399
40	202218	1598411	1577535	20876	979341
41	202503	1597002	1576067	20936	979282
42	202787	1595597	1574601	20996	979223
43	203072	1594194	1573137	21056	979164
44	203357	1592792	1571675	21117	979105
45	203642	1591393	1570215	21177	979046
46	203927	1589995	1568757	21238	978986
47	204211	1588600	1567301	21298	978927
48	204496	1587206	1565846	21359	978867
49	204781	1585815	1564395	21420	978808
50	205066	1584425	1562944	21481	978749
51	205350	1583037	1561493	21542	978689
52	205635	1581652	1560049	21603	978629
53	205920	1580269	1558604	21664	978569
54	206204	1578887	1557162	21725	978509
55	206489	1577508	1555721	21787	978449
56	206774	1576132	1554282	21848	978389
57	207058	1574756	1552840	21910	978329
58	207343	1573382	1551411	21971	978268
59	207627	1572011	1549978	22033	978208
60	207912	1570641	1548547	22095	978148

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Deg. 12 +1-

m.	Sines.	Logarith.	Differen.	Logarit.	Sines.
0	207912	1570641	1548547	22095	978148 60
1	208196	1569274	1547117	22157	978087 59
2	208481	1567908	1545690	22219	978026 58
3	208765	1566544	1544264	22281	977966 57
4	209050	1565183	1542840	22343	977905 56
5	209334	1563823	1541418	22405	977844 55
6	209618	1562465	1539998	22467	977783 54
7	209903	1561109	1538580	22530	977722 53
8	210187	1559755	1537163	22592	977661 52
9	210472	1558403	1535748	22655	977600 51
10	210756	1557053	1534336	22717	977539 40
11	211040	1555705	1532925	22780	977477 49
12	211325	1554358	1531515	22843	977416 48
13	211609	1553014	1530108	22906	977354 37
14	211893	1551671	1528703	22969	977293 46
15	212178	1550331	1527299	23032	977231 45
16	212462	1548992	1525897	23095	977169 44
17	212746	1547655	1524497	23158	977107 43
18	213030	1546320	1523098	23222	977046 42
19	213315	1544987	1521701	23285	976984 41
20	213599	1543655	1520306	23349	976921 40
21	213883	1542326	1518913	23413	976859 39
22	214167	1540998	1517522	23476	976797 38
23	214451	1539672	1516132	23540	976735 37
24	214735	1538348	1514744	23604	976672 36
25	215019	1537026	1513358	23668	976610 35
26	215303	1535706	1511974	23732	976547 34
27	215588	1534387	1510591	23796	976484 33
28	215872	1533071	1509210	23861	976422 32
29	216156	1531756	1507831	23925	976359 31
30	216440	1530443	1506453	23989	976297 30

Min.

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Deg. 12 + | -

m	Sines.	Logarith.	Differen.	Logarit.	Sines.
30	216440	1530443	1506453	23989	976296
31	216724	1529132	1505078	24054	976233
32	217008	1527823	1503704	24119	976170
33	217292	1526515	1502332	24183	976107
34	217575	1525209	1500961	24248	976043
35	217859	1523905	1499592	24312	975980
36	218143	1522603	1498225	24378	975917
37	218427	1521302	1496859	24443	975853
38	218711	1520004	1495495	24508	975790
39	218995	1518707	1494133	24573	975726
40	219279	1517412	1492773	24639	975662
41	219562	1516118	1491414	24704	975598
42	219846	1514827	1490057	24770	975535
43	220130	1513537	1488701	24835	975470
44	220414	1512248	1487347	24901	975406
45	220697	1510962	1485995	24967	975342
46	220981	1509677	1484645	25033	975278
47	221265	1508394	1483296	25099	975214
48	221548	1507113	1481946	25165	975149
49	221832	1505834	1480603	25231	975085
50	222116	1504556	1479259	25297	975020
51	222400	1503280	1477917	25363	974956
52	222683	1502006	1476576	25430	974891
53	222967	1500733	1475237	25496	974826
54	223250	1499462	1473899	25563	974761
55	223534	1498193	1472563	25629	974696
56	223817	1496925	1471229	25696	974631
57	224101	1495659	1469896	25763	974566
58	224384	1494395	1468565	25830	974501
59	224668	1493132	1467235	25897	974435
60	224951	1491871	1465908	25964	974370

Min.

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Deg. 13 + -

m.	Sines.	Logarith.	Differen.	Logarit.	Sines.
0	224951	1491872	1465907	25964	97437060
1	225234	1490612	1464581	26031	97430459
2	225518	1489355	1463256	26097	97423958
3	225801	1488099	1461933	26166	97417357
4	226085	1486845	1460612	26234	97410856
5	226368	1485593	1459291	26301	97404255
6	226651	1484341	1457973	26369	97397654
7	226935	1483093	1456656	26436	97391053
8	227217	1481845	1455341	26504	97384452
9	227501	1480599	1454027	26572	97377851
10	227784	1479355	1452715	26640	97371150
11	228068	1478113	1451405	26708	97364549
12	228351	1476872	1450095	26776	97357948
13	228634	1475632	1448788	26845	97351237
14	228917	1474395	1447482	26913	97344646
15	229200	1473158	1446177	26981	97337945
16	229483	1471924	1444874	27050	97331244
17	229767	1470691	1443572	27118	97324643
18	230050	1469459	1442274	27187	97317942
19	230332	1468230	1440974	27256	97311241
20	230616	1467001	1439677	27325	97304640
21	230894	1465775	1438381	27394	97297839
22	231181	1464550	1437087	27463	97291038
23	231469	1463326	1435794	27532	97284237
24	231748	1462104	1434503	27601	97277436
25	232031	1460884	1433213	27671	97270635
26	232314	1459665	1431925	27740	97263834
27	232597	1458448	1430638	27810	97257033
28	232880	1457233	1429353	27879	97250232
29	233162	1456019	1428070	27949	97243431
30	233445	1454807	1426788	28019	97236630

Min

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Deg. 13 + —

m.	Sines.	Logarith.	Differen	Logarit.	Sines.
30	233445	1454807	1426788	28019	972370
31	233728	1453596	1425507	28089	972302
32	234011	1452387	1424228	28159	972234
33	234294	1451179	1422950	28229	972166
34	234577	1449973	1421674	38299	972098
35	234859	1448768	1420399	28369	972029
36	235142	1447565	1419125	28439	971961
37	235425	1446363	1417853	28510	971893
38	235707	1445163	1416583	28580	971824
39	235990	1443965	1415313	28651	971755
40	236273	1442767	1414046	28722	971687
41	236555	1441572	1412779	28792	971618
42	236838	1440378	1411514	28863	971549
43	237121	1439185	1410251	28934	971480
44	237403	1437994	1408989	29005	971411
45	137686	1436805	1407728	29076	971342
46	137968	1435616	1406469	29148	971272
47	138251	1434430	1405211	29219	971204
48	230533	1433245	1403955	29290	971134
49	238816	1432062	1402700	29362	971065
50	239098	1430080	1401446	29433	970995
51	239381	1429699	1400194	29505	970926
52	239663	1428520	1398943	29577	970856
53	239946	1327342	1397693	29649	970786
54	240228	1426166	1396445	29721	970716
55	240510	1424991	1395199	29792	970647
56	240793	1423818	1393953	29865	970577
57	241075	1422646	1392709	29937	970506
58	241357	1421476	1391467	30009	970436
59	241640	1420307	1390225	30082	970366
60	241922	1419140	1388985	30154	970296

Mix

Deg. 76

Deg. 14 + —

mi.	Sines.	Logarith.	Differen.	Logarit.	Sines.
0	241922	1419140	1388985	30154	970296
1	242204	1417974	1387747	30227	970225
2	242486	1416809	1386509	30300	970155
3	242768	1415645	1385274	30372	970084
4	243051	1414484	1384039	30445	970013
5	243333	1413324	1382806	30518	969943
6	243615	1412165	1381574	30591	969872
7	243897	1411008	1380344	30664	969801
8	244179	1409852	1379115	30737	969730
9	244461	1408698	1377887	30811	969659
10	244743	1407545	1376661	30884	969588
11	245025	1406393	1375435	30958	969517
12	245307	1405243	1374212	31031	969445
13	245589	1404094	1372989	31105	969374
14	245871	1402946	1371768	31179	969302
15	246153	1401800	1370548	31252	969231
16	246435	1400656	1369329	31326	969159
17	246717	1399512	1368112	31400	969088
18	246999	1398370	1366896	31474	969016
19	247281	1397230	1365681	31549	968944
20	247563	1396091	1364468	31623	968872
21	247845	1394953	1363256	31697	968800
22	248126	1393817	1362045	31772	968728
23	248408	1392682	1360835	31846	968655
24	248690	1391548	1359627	31921	968583
25	248972	1390416	1358420	31996	968511
26	249253	1389285	1357214	32070	968438
27	249535	1388155	1356010	32145	968366
28	249817	1387027	1354807	32220	968293
29	250098	1385900	1353605	32295	968225
30	250380	1384775	1352404	32371	968148

M.N.

Deg. 75

Deg. 14 +|-

m.	Sines.	Logarith.	Differen.	Logarith.	Sines.	
30	250380	1384775	1352404	32371	668148	30
31	250663	1383651	1351205	32446	968075	29
32	250943	1382528	1350007	32521	968002	28
33	251225	1381407	1348810	32597	967929	27
34	251506	1380286	1347614	32671	967856	26
35	251788	1379168	1346420	3274	967782	25
36	252069	1378050	1345227	32821	967709	24
37	252351	1376934	1344035	32895	967636	23
38	252632	1375819	1342844	32975	967562	22
39	252914	1374706	1341655	33051	967489	21
40	253195	1373594	1340466	33127	967415	20
41	253477	1372483	1339280	33204	967341	19
42	253758	1371374	1338094	33280	967268	18
43	254039	1370266	1336910	33356	967194	17
44	254321	1369159	1335726	33433	967120	16
45	254602	1368053	1334544	33509	967046	15
46	254883	1366949	1333363	33586	966972	14
47	255164	1365846	1332184	33663	966898	13
48	255446	1364744	1331005	33739	966823	12
49	255727	1363644	1329828	33816	966749	11
50	256008	1362545	1328652	33893	966675	10
51	256289	1361447	1327477	33970	966600	9
52	256571	1360351	1326303	34048	966525	8
53	256852	1359256	1325131	34125	966451	7
54	257133	1358162	1323960	34202	966376	6
55	257414	1357069	1322790	34280	966301	5
56	257695	1355978	1321621	34357	966226	4
57	257976	1354888	1320453	34435	966151	3
58	258257	1353799	1319287	34513	966076	2
59	258538	1352711	1318121	34590	966001	1
60	258819	1351625	1316957	34668	965926	0

Min.

Deg. 75

Deg. 15 +1—

mi	Sines.	Logarith	Differen.	Logarith.	Sines.
0	258819	1351625	1316557	34668	96592760
1	259100	1350541	1315794	34746	96585059
2	259381	1349457	1314633	34824	96577558
3	259662	1348375	1313472	34903	96470057
4	259943	1347293	1312313	34980	96462456
5	260224	1346213	1311154	35059	96554855
6	260504	1345135	1309997	35137	96547354
7	260785	1344057	1308841	35216	96539653
8	261066	1342981	1307686	35295	96532152
9	261347	1341906	1306533	35373	96524551
10	261628	1340832	1305380	35452	96516950
11	261908	1339760	1304229	35531	96509349
12	262189	1338688	1303078	35610	96501648
13	262470	1337618	1301929	35689	96494047
14	262750	1336549	1300781	35768	96486446
15	263031	1335482	1299634	35848	96478755
16	263312	1334415	1298488	35927	96471144
17	263592	1333350	1297344	36006	96463443
18	263873	1332286	1296200	36086	96455742
19	264154	1331224	1295058	36165	96448141
20	264434	1330162	1293917	36245	96440340
21	264715	1329102	1292777	36325	96432739
22	264995	1328043	1291638	36405	96425038
23	265276	1326985	1290500	36485	96417337
24	265556	1325929	1289364	36565	96409536
25	265837	1324873	1288228	36645	96401835
26	266117	1323819	1287094	36725	96394134
27	266397	1322766	1285960	36806	96386333
28	266678	1321714	1284828	36886	96378632
29	266958	1320663	1283696	36967	96370831
30	267238	1319614	1282566	37047	96363030

Min.

Deg. 74

Deg. 15 +1-

m	Sines.	Logarith	Differen.	Logarit.	Sines.
30	167238	1319613	1281566	37047	963630
31	167519	1318565	1281437	37128	963553
32	167799	1317518	1280309	37209	963475
33	168079	1316472	1279182	37290	963397
34	168359	1315427	1278056	37371	963319
35	168640	1314383	1276932	37452	963241
36	168920	1313341	1275808	37533	963162
37	169200	1312300	1274686	37614	963084
38	169480	1311259	1273564	37696	963006
39	169760	1310221	1272444	37777	962927
40	170040	1309183	1271325	37859	962849
41	170320	1308146	1270206	37940	962772
42	170600	1307111	1269089	38022	962692
43	170880	1306077	1267973	38104	962613
44	171160	1305044	1266858	38186	962534
45	171440	1304012	1265744	38268	962455
46	171720	1302981	1264631	38350	962376
47	172000	1301951	1263519	38432	962297
48	172280	1300922	1262409	38514	962218
49	172560	1299895	1261299	38597	962139
50	172840	1298869	1260190	38679	962059
51	173120	1297844	1259082	38762	961980
52	173400	1296820	1257976	38844	961900
53	173679	1295797	1256870	38927	961821
54	173959	1294775	1255766	39010	961741
55	174239	1293754	1254662	39092	961662
56	174519	1292735	1253560	39176	961582
57	174798	1291717	1252458	39259	961502
58	175078	1290699	1251358	39342	961422
59	175350	1289683	1250259	39425	961342
60	175637	1288668	1249160	39509	961262

M.F.

G

Deg. 74

Deg. 16 +

m.	Sines.	Logarith.	Differen.	Logarit	Sines
0	275637	1288669	1249160	39509	96126260
1	275917	1287655	1248063	39592	96118159
2	276196	1286642	1246967	39676	96110158
3	276476	1285631	1245871	39759	96102157
4	276756	1284620	1244777	39843	96094056
5	277035	1283610	1243684	39927	96086055
6	277315	1282602	1242591	40010	96079054
7	277594	1281595	1241500	40095	96072053
8	277873	1280589	1240410	40179	96065052
9	278153	1279583	1239320	40263	96058051
10	278432	1278579	1238232	40347	96051050
11	278712	1277577	1237145	40432	96044049
12	278991	1276575	1236059	40516	96037048
13	279270	1275574	1234973	40601	96030047
14	279550	1274574	1233889	40685	96023046
15	279830	1273576	1232806	40770	96016045
16	280108	1272578	1231723	40855	96009044
17	280387	1271582	1230642	40940	96002043
18	280667	1270587	1229562	41025	95995042
19	280946	1269592	1228483	41110	95988041
20	281225	1268599	1227404	41195	95981040
21	281504	1267607	1226327	41280	95974039
22	281783	1266617	1225251	41366	95967038
23	282062	1265627	1224175	41451	95960037
24	282341	1264638	1223101	41537	95953036
25	282624	1263650	1222027	41623	95946035
26	282899	1262663	1220955	41708	95939034
27	283178	1261678	1219783	41794	95932033
28	283457	1260693	1218813	41880	95925032
29	283736	1259709	1217743	41966	95918031
30	284015	1258727	1216675	42052	95911030

Min

Deg. 73

Deg. 16 + | —

	Sines	Logarith	Differen.	Logarit	Sines	
60						
59	30 284015	258727	1216675	42052	958820	30
58	31 284294	125774	1215607	42138	958737	29
57	32 284573	256765	1214540	42225	958654	28
56	33 284852	255785	1213474	42311	958572	27
55	34 285131	254807	1212409	42397	958489	26
54	35 285410	1253820	1211345	42484	958406	25
53	36 285688	1252853	1210282	42571	958323	24
52	37 285967	1251878	1209220	42658	958239	23
51	38 286246	1250904	1208159	42744	958156	22
50	39 286525	1249930	1207099	42831	958073	21
49	40 286803	1248958	1206040	42918	957990	20
48	41 287082	1247987	1204982	43005	957906	19
47	42 287360	1247017	1203925	43093	957822	18
46	43 287639	1246048	1202868	43180	957739	17
45	44 287918	1245080	1201813	43267	957655	16
44	45 288196	1244113	1200758	43355	957571	15
43	46 288475	1243147	1199705	43442	957487	14
42	47 288753	1242182	1198652	43530	957404	13
41	48 289032	1241218	1197600	43618	957320	12
40	49 289310	1240255	1196549	43706	957235	11
39	50 289589	1239293	1195500	43794	957151	10
38	51 289867	1238332	1194451	43882	957067	9
37	52 290146	1237372	1193402	43970	956983	8
36	53 290424	1236413	1192355	44058	956898	7
35	54 290702	1235455	1191309	44146	956814	6
34	55 290981	1234498	1190264	44234	956729	5
33	56 291259	1233542	1189219	44322	956644	4
32	57 291537	1232588	1188176	44410	956560	3
31	58 291815	1231634	1187133	44498	956475	2
30	59 292093	1230681	1186091	44586	956390	1
Min	6 292372	1229728	1185050	44674	956305	0

Min

c : Deg. 73

Deg. 17 +

n	Sines.	Logarith.	Differen.	Logarit	Sines.
0	92372	1229729	1185050	44678	95630560
1	92650	1228778	1184010	44767	95612059
2	92928	1227828	1182971	44858	95613458
3	93206	1226879	1181933	44945	95604957
4	93484	1225931	1180896	45035	95596456
5	93762	1224984	1179859	45124	95587855
6	94040	1224038	1178824	45214	95579354
7	94318	1223093	1177789	45303	95570753
8	94596	1222149	1176756	45393	95562252
9	94874	1221206	1175723	45482	95553651
10	95152	1220263	1174691	45572	95545050
11	95430	1219322	1173660	45662	95536449
12	95708	1218382	1172629	45752	95527848
13	95986	1217443	1171600	45842	95519247
14	96263	1216504	1170572	45932	95510646
15	96542	1215567	1169544	46023	95502045
16	96819	1214631	1168517	46113	95493444
17	97097	1213695	1167491	46204	95484843
18	97375	1212761	1166466	46294	95476242
19	97653	1211828	1165442	46385	95467641
20	97930	1210895	1164419	46475	95458840
21	98208	1209964	1163397	46566	95450239
22	98486	1209033	1162376	46657	95441638
23	98763	1208104	1161355	46748	95433037
24	99041	1207175	1160335	46839	95424436
25	99318	1206247	1159316	46930	95415835
26	99596	1205320	1158298	47022	95407234
27	99873	1204394	1157281	47113	95398633
28	100151	1203470	1156265	47205	95389932
29	100428	1202546	1155249	47296	95381331
30	100706	1201623	1154234	47388	95372730

ALM.

Deg. 72

Deg. 17



m	Sines	Logarith.	Differen.	Logarit	Sines
30	300706	1201622	154234	47388	95371730
31	300983	120070	1153220	47480	95362929
32	301261	1199779	1152207	47572	95354228
33	301538	1198859	1151195	47664	95345427
34	301815	1197940	1150183	47756	95336626
35	302092	1197021	1149173	47848	95327925
36	302370	1196104	1148163	47940	95319124
37	302647	1195187	1147154	48033	95310323
38	302924	1194272	1146146	48125	95301522
39	303202	1193357	1145139	48218	95292721
40	303478	1192443	1144133	48310	95283920
41	303756	1191520	1143127	48403	95275119
42	304033	1190618	1142123	48496	95266318
43	304310	1189707	1141119	48589	95257517
44	304587	1188797	1140116	48682	95248716
45	304864	1187885	1139113	48775	95239915
46	305141	1186980	1138112	48868	95231114
47	305418	1186072	1137111	48961	95222313
48	305695	1185166	1136111	49054	95213512
49	305972	1184260	1135112	49148	95204711
50	306249	1183356	1134114	49241	95195910
51	306526	1182452	1133117	49335	95187109
52	306803	1181549	1132121	49429	95178308
53	307080	1180647	1131125	49522	95169507
54	307357	1179746	1130130	49616	95160706
55	307633	1178846	1129136	49710	95151905
56	307910	1177947	1128142	49804	95143104
57	308187	1177048	1127150	49899	95134303
58	308464	1176151	1126158	49993	95125502
59	308740	1175254	1125167	50087	95116701
60	309017	1174359	1124177	50181	95107900

M. B.

Deg. 18

m.	Sines.	Logarith.	Difference	Logarith.	Sines
0	309017	1174359	1124177	50182	95105660
1	309294	1173464	1123187	50276	95096759
2	309570	1172570	1122199	50371	95087758
3	309847	1171677	1121211	50466	95078757
4	310123	1170785	1120224	50561	95069656
5	310400	1169893	1119238	50656	95060655
6	310676	1169000	1118252	50751	95051654
7	310953	1168113	1117268	50846	95042543
8	311229	1167225	1116284	50941	95033552
9	311506	1166337	1115301	51036	95024451
10	311782	1165450	1114318	51132	95015450
11	312059	1164562	1113337	51227	95006349
12	312335	1163679	1112356	51323	94997248
13	312611	1162794	1111376	51418	94988147
14	312887	1161911	1110397	51514	94979046
15	313164	1161028	1109418	51610	94969945
16	313440	1160147	1108440	51706	94960844
17	313716	1159266	1107464	51802	94951743
18	313992	1158386	1106488	51898	94942542
19	314269	1157507	1105512	51994	94933441
20	314545	1156628	1104538	52091	94924340
21	314821	1155751	1103564	52187	94915139
22	315097	1154875	1102591	52284	94906038
23	315374	1153999	1101618	52380	94896837
24	315649	1153124	1100647	52477	94887636
25	315925	1152251	1099676	52574	94878435
26	316201	1151377	1098706	52670	94869234
27	316477	1150504	1097737	52768	94860033
28	316753	1149633	1096768	52865	94850832
29	317029	1148762	1095800	52962	94841631
30	317305	1147893	1094833	53059	94832430

M.A.

Deg. 71

Deg. 18

+1—

m	Sines	Logarith.	Differen.	Logarit.	Sines
60	30317305	1147893	1094833	53059	94832430
59	31317580	1147024	1093867	53157	94823129
58	32317856	1146156	1092901	53254	94813928
57	33318132	1145288	1091936	53352	94804627
56	34318408	1144422	1090972	53450	94795426
55	35318684	1143556	1090009	53547	94786125
54	36318959	1142691	1089046	53645	94776824
53	37319235	1141827	1088084	53743	94767623
52	38319511	1140964	1087123	53841	94758322
51	39319786	1140102	1086163	53939	94749021
50	40320062	1139241	1085203	54037	94739720
49	41320337	1138380	1084244	54136	94730319
48	42320613	1137520	1083286	54234	94721018
47	43320888	1136661	1082329	54332	94711717
46	44321164	1135803	1081372	54431	94702416
45	45321439	1134946	1080416	54530	94693015
44	46321715	1134089	1079460	54629	94683714
43	47321990	1133233	1078506	54727	94674313
42	48322266	1132378	1077552	54826	94664912
41	49322541	1131524	1076599	54926	94655511
40	50322816	1130671	1075646	55025	94646210
39	51323092	1129819	1074694	55124	94636809
38	52323367	1128967	1073743	55224	94627408
37	53323642	1128116	1072793	55323	94618007
36	54323917	1127266	1071844	55423	94608606
35	55324193	1126417	1070895	55522	94599205
34	56324468	1125569	1069947	55622	94589804
33	57324743	1124721	1068999	55722	94580403
32	58325018	1123874	1068053	55822	94571002
31	59325293	1123028	1067107	55922	94561601
30	60325568	1122183	1066161	56022	94552200

1117

Dec. 19

+1-

m. Sines	Logarithm	Differen	Logarithm	Sines
0 325568	11122183	1066161	56022	94551960
1 325843	11121339	1065217	56122	94542459
2 326118	11120495	1064273	56222	94532958
3 326393	11119652	1063330	56323	94523457
4 326668	11118810	1062387	56423	94513956
5 326943	11117969	1061445	56524	94504455
6 327218	11117129	1060504	56624	94494954
7 327493	11116289	1059564	56725	94485453
8 327767	11115450	1058624	56826	94475952
9 328042	11114612	1057685	56927	94466451
10 328317	11113775	1056747	57028	94456950
11 328592	11112938	1055809	57129	94447449
12 328866	11112102	1054872	57230	94437948
13 329141	11111266	1053936	57332	94428447
14 329416	11110433	1053000	57433	94418946
15 329691	11109600	1052065	57534	94409445
16 329965	11108757	1051131	57636	94399944
17 330240	11107926	1050198	57738	94390443
18 330514	11107105	1049265	57840	94380942
19 330789	11106274	1048333	57942	94371441
20 331063	11105445	1047401	58044	94361940
21 331338	11104616	1046470	58146	94352439
22 331612	11103788	1045540	58248	94342938
23 331887	11102961	1044611	58350	94333437
24 332161	11102135	1043682	58453	94323936
25 332435	11101309	1042754	58555	94314435
26 332710	11100484	1041826	58658	94304934
27 332984	10999660	1040899	58761	94295433
28 333258	10998837	1039973	58863	94285932
29 333533	10998014	1039048	58966	94276431
30 333807	10997192	1038123	59069	94266930

M:n.

Dec. 70

Deg. 19 + / -

mi	Sines	Logarith.	Differen	Logarit.	Sines
60	333807	1097192	103812	59069	94264130
59	334081	1096371	1037199	59172	94254429
58	334355	1095551	103627	59275	94244728
57	334629	1094731	1035353	59378	94235027
56	334903	1093912	1034430	59482	94225226
55	335178	1093094	1033509	59585	94215525
54	335452	1092277	1032588	59689	94205724
43	335726	1091461	1031668	59792	94196023
52	336000	1090645	1030749	59896	94186222
51	336274	1089830	1029830	60000	94176421
50	336547	1089016	1028911	60104	94166620
49	336821	1088202	1027994	60208	94156819
48	337095	1087389	1027077	60312	94147018
47	337369	1086577	1026161	60416	94137217
46	337643	1085766	1025245	60520	94127416
45	337917	1084955	1024330	60625	94117615
44	338190	1084146	1023416	60730	94107814
43	338464	1083337	1022502	60834	94097913
42	338738	1082525	1021589	60939	94088112
41	339011	1081721	1820677	61044	94078211
40	339285	1080914	1019765	61148	94068410
39	339559	1080107	1018854	61253	9405859
38	339832	1079302	1017944	61358	9404868
37	340106	1078497	1017034	61463	9403877
36	340379	1077693	1016125	61569	9402886
35	340653	1076890	1015216	61674	9401895
34	340926	1076088	1014308	61779	9400904
33	341200	1075286	1013401	61885	9399913
32	341473	1074485	1012494	61991	9398922
31	341747	1073685	1011588	62097	9397931
30	342020	1072885	1010683	62202	9396940

Min.

65

Deg. 70

Deg. 20



m.	Sines	Logarith.	Differen.	Logarit.	Sines
0	340020	1072835	1010653	62202	93969360
1	342227	1072086	1009778	62308	93959359
2	342567	1071288	1008874	62414	93949358
3	342840	1070491	1007971	62520	93939457
4	343113	1069694	1007068	62627	93929456
5	343386	1068898	1006165	62733	93919455
6	343660	1068103	1005264	62839	93909454
7	343933	1067308	1004363	62946	93899453
8	344206	1066513	1003462	63052	93889452
9	344479	1065723	1002562	63159	93879451
10	344752	1064929	1001663	63266	93869450
11	345025	1064137	1000765	63373	93859449
12	345298	1063346	999867	63480	93849448
13	345571	1062556	998969	63587	93839447
14	345844	1061767	998072	63694	93829446
15	346117	1060978	997176	63801	93819445
16	346390	1060190	996281	63909	93809444
17	346663	1059402	995386	64016	93799443
18	346936	1058616	994492	64124	93789442
19	347209	1057830	993598	64231	93779441
20	347481	1057044	992705	64339	93769440
21	347754	1056260	991813	64447	93759439
22	348027	1055476	990921	64555	93749438
23	348299	1054693	990030	64662	93739437
24	348572	1053910	989140	64771	93729436
25	348845	1053129	988250	64879	93719435
26	349117	1052347	987360	64987	93709434
27	349390	1051567	986471	65096	93699433
28	349662	1050787	985583	65204	93689432
29	349934	1050008	984695	65312	93679431
30	350207	1049229	983808	65422	93669430

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Deg. 20 +1—

	Sines	Logarith.	Differen	Logarit.	Sines	
30	350207	1049229	933808	65422	936672	30
31	350480	1048452	982921	65531	936570	29
32	350752	1047674	982035	65640	936468	28
33	351025	1046898	981149	65749	936366	27
34	351297	1046122	980265	65858	936264	26
35	351569	1845348	979381	65967	936162	25
36	351842	1044573	978497	66076	936059	24
37	352114	1043800	977614	66186	935957	23
38	352386	1043027	976732	66295	935855	22
39	352658	1042255	975850	66405	935752	21
40	352931	1041484	974969	66514	935649	20
41	353203	1040713	974089	66624	935547	19
42	353475	1039943	973209	66734	935444	18
43	353747	1039173	972330	66844	935341	17
44	354019	1038405	971451	66954	935238	16
45	354291	1037637	970573	67064	935135	15
46	354563	1036869	969695	67174	935032	14
47	354835	1036102	968818	67284	934929	13
48	355107	1035336	967941	67395	934826	12
49	355379	1034571	967065	67506	934722	11
50	355651	1033806	966189	67616	934619	10
51	355923	1033041	965314	67727	934515	9
52	356194	1032278	964440	67838	934412	8
53	356466	1031515	963566	67949	934308	7
54	356738	1030753	962693	68060	934204	6
55	357010	1029992	961820	68171	934101	5
56	357281	1029231	960948	68282	933997	4
57	357553	1828471	960077	68394	933893	3
58	357825	1027711	959206	68505	933790	2
59	358096	1026953	958336	68617	933685	1
60	358368	1026195	957466	68728	933580	0

M. A.

Deg. (9)

Deg. 21



m.	Sines	Logarith.	Differen.	Logarit.	Sines	m.
0	358368	1026195	957466	68728	933580	30
1	358639	1025437	956597	68840	933476	29
2	358911	1024680	955729	68952	933372	28
3	359182	1023924	954861	96064	933267	27
4	359454	1023169	953993	96176	933163	26
5	359725	1022414	953126	96288	933058	25
6	359997	1021660	952260	69400	932953	24
7	360268	1020906	951394	69512	932849	23
8	360539	1020153	950529	69625	932744	22
9	360811	1019401	949664	69737	932639	21
10	361082	1018650	948800	69849	932534	20
11	361353	1017899	947937	69962	932429	19
12	361624	1017148	947074	70075	932324	18
13	361896	1016399	946211	70188	932219	17
14	362167	1015650	645349	70301	932113	16
15	362438	1014901	944488	70414	932008	15
16	362709	1014154	943627	70527	931902	14
17	362980	1013407	942766	70640	931797	13
18	363251	1012660	941907	70754	931691	12
19	363522	1011914	941047	70867	931586	11
20	363793	1011169	940189	70981	931480	10
21	364064	1010425	939330	71094	931374	9
22	364335	1009681	938473	71208	931268	8
23	364606	1008938	937616	71322	931162	7
24	364877	1008195	936759	71436	931056	6
25	365148	1007453	935903	71550	930950	5
26	365418	1006712	935048	71664	930843	4
27	365689	1005971	934193	71778	930737	3
28	365960	1005231	933339	71893	930631	2
29	366231	1004492	932485	72007	930524	1
30	366501	1003753	931631	72122	930418	0

Min.

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m.	Sines.	Logarith.	Differen.	Logarit.	Sines.
30	366501	1003753	931631	72112	930418 60
29	366772	1003015	930778	72236	930311 59
28	367042	1002277	929926	72351	930204 58
27	367313	1001540	929074	72466	930097 57
26	367583	1000804	928223	72581	929990 56
25	367854	1000068	927373	72696	929884 55
24	368125	999333	926521	72811	929777 54
23	368395	998599	925673	72926	929669 53
22	368665	997865	924824	73041	929562 52
21	368936	997134	923975	73157	929455 51
20	369206	996400	923127	73272	929348 50
19	369476	995668	922280	73388	929240 49
18	369747	994937	921433	73504	929133 48
17	370017	994206	920586	73619	929025 47
16	370287	993476	919741	73735	928917 46
15	370557	992747	918895	73851	928810 45
14	370828	992018	918050	73967	928702 44
13	371098	991290	917206	74084	928594 43
12	371368	990562	916362	74200	928486 42
11	371638	989835	915519	74316	928378 41
10	371908	989109	914676	74433	928270 40
9	372178	988383	913833	94549	928161 39
8	372448	987658	912991	74666	928053 38
7	372718	986933	912150	74783	927945 37
6	372988	986209	911309	74900	927836 36
5	373258	985486	910469	75017	927728 35
4	373527	984763	909629	75134	927619 34
3	373797	984041	908790	75251	927510 33
2	374067	983319	907951	75368	927402 32
1	374337	982599	907113	75486	927293 31
0	374607	981878	906275	75603	927184 30

Mm.

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+1—

m.	Sines	Logarith	Differen.	Logarit.	Sines.	
0	374607	981878	906275	75603	927184	60
1	374876	981159	905438	75721	927075	59
2	375146	980440	904601	75838	926966	58
3	375416	979721	903765	75956	926857	57
4	375685	979004	902630	76074	926747	56
5	375955	978286	902094	76192	926638	55
6	376224	977570	901259	76310	926529	54
7	376494	976853	900425	76428	926419	53
8	376763	976138	899591	76547	926310	52
9	377033	975423	898758	76665	926200	51
10	377302	974709	897925	76783	926090	50
11	377571	973995	897093	76902	925980	49
12	377841	973282	896261	77021	925871	48
13	378110	972569	895430	77140	925761	47
14	378379	971857	894599	77259	925651	46
15	378649	971146	893769	77378	925541	45
16	378918	970435	892939	77497	925430	44
17	379187	969725	892120	77616	925320	43
18	379456	969016	891281	77735	925210	42
19	379725	968307	890453	77854	925099	41
20	379994	967599	889625	77974	924989	40
21	380263	966891	888798	78093	924878	39
22	380532	966184	887971	78213	924768	38
23	380801	965477	887145	78332	924657	37
24	381070	964771	886319	78452	924546	36
25	381339	964065	885493	78572	924435	35
26	381608	963360	884668	78692	924324	34
27	381877	962656	883844	78812	924213	33
28	382146	961952	883020	78933	924102	32
29	382415	961249	882196	79053	923991	31
30	382683	960547	881373	79174	923879	30

Min.

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Deg. 22 +1—

m.	Sines	Logarit.	Differē.	Logarit.	Sines.
60	30382683	960547	881373	79174	92387930
59	31382952	959845	880551	79294	92376829
58	32383221	659143	879728	79415	92365728
57	33383489	958443	378907	79536	92354527
56	34383758	957742	378086	79656	92343426
55	35384027	957042	377265	79777	92332225
54	36384295	956344	376445	79898	92321024
53	37384564	955645	375626	80019	92309823
52	38384832	954947	374806	80141	92298722
51	39385101	954250	373988	80262	92287521
50	40385369	953553	373170	80383	92276320
49	41385638	952857	372352	80505	92265119
48	42385906	952161	371534	80626	92253918
47	43386174	951466	370718	80748	92242717
46	44386443	950771	369901	80870	92231516
45	45386710	950077	369085	80992	92220315
44	46386979	949384	368270	81114	92209114
43	47387247	948691	367455	81236	92197913
42	48387515	947999	366640	81358	92186712
41	49387784	947307	365826	81481	92175511
40	50388052	946616	365013	81603	92164310
39	51388320	945925	364200	81726	92153109
38	52388588	945235	363388	81848	92141908
37	53388856	944546	362575	81971	92130707
36	54389124	943857	361763	82094	92119506
35	55389392	943169	360952	82217	92108305
34	56389660	942481	360141	82340	92097104
33	57389928	941794	359331	82463	92085903
32	58390195	941107	358521	82586	92074702
31	59390463	940421	357712	82709	92063501
30	60390731	939735	356903	82833	92052300

Min.

Deg. 67

Deg. 22 +1—

m.	Sines	Logarith	Differen.	Logarit.	Sines.	
0	374607	981878	906275	75603	927184	60
1	374876	981159	905438	75721	927075	59
2	375146	980440	904601	75838	926966	58
3	375416	979721	903765	75956	926857	57
4	375685	979004	902630	76074	926747	56
5	375955	978286	902094	76192	926638	55
6	376224	977570	901259	76310	926529	54
7	376494	976853	900425	76428	926419	53
8	376763	976138	899591	76547	926310	52
9	377033	975423	898758	76665	926200	51
10	377302	974709	897925	76783	926090	50
11	377571	973995	897093	76902	925980	49
12	377841	973282	896261	77021	925871	48
13	378110	972569	895430	77140	925761	47
14	378379	971857	894599	77259	925651	46
15	378649	971146	893769	77378	925541	45
16	378918	970435	892939	77497	925430	44
17	379187	969735	892120	77616	925320	43
18	379456	969016	891281	77735	925210	42
19	379725	968307	890453	77854	925099	41
20	379994	967599	889625	77974	924989	40
21	380263	966891	888798	78093	924878	39
22	380532	966184	887971	78213	924768	38
23	380801	965477	887145	78332	924657	37
24	381070	964771	886319	78452	924546	36
25	381339	964065	885493	78572	924435	35
26	381608	963360	884668	78692	924324	34
27	381877	962656	883844	78812	924213	33
28	382146	961952	883020	78933	924102	32
29	382415	961249	882196	79053	923991	31
30	382683	960547	881373	79174	923879	30

Min.

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Deg. 22 + | —

m.	Sines	Logarit.	Differē.	Logarit.	Sines.
60	30382683	960547	381373	79174	92387930
59	31382952	959845	380551	79294	92376829
58	32383221	659143	379728	79415	92365728
57	33383489	958443	378907	79536	92354527
56	34383758	957742	378086	79656	92343426
55	35384027	957042	377265	79777	92332225
54	36384295	956344	376445	79898	92321024
53	37384564	955645	375626	80019	92309823
52	38384832	954947	374806	80141	92298722
51	39385101	954250	373988	80262	92287521
50	40385369	953553	373170	80383	92276220
49	41385638	952857	372352	80505	92265019
48	42385906	952161	371534	80626	92253818
47	43386174	951466	370718	80748	92242617
46	44386443	950771	369901	80870	92231316
45	45386710	950077	369085	80992	92220115
44	46386979	949384	368270	81114	92208814
43	47387247	948691	367455	81236	92197613
42	48387515	947999	366640	81358	92186312
41	49387784	947307	365826	81481	92175011
40	50388052	946616	365013	81603	92163810
39	51388320	945925	364200	81726	9215259
38	52388588	945235	363388	81848	9214128
37	53388856	944546	362575	81971	9212997
36	54389124	943857	361763	82094	9211856
35	55389392	943169	360952	82217	9210725
34	56389660	942481	360141	82340	9209594
33	57389928	941794	359331	82463	9208463
32	58390195	941107	358521	82586	9207322
31	59390463	940421	357712	82709	9206181
30	60390731	939735	356903	82833	9205050

Min.

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m	Sines	Logarit.	Differé	Logarit.	Sines	m
0	390731	939735	356203	82833	920505	60
1	390999	939050	856094	82956	920391	59
2	331267	937366	855286	83080	920277	58
3	391534	937682	854478	83204	920163	57
4	391802	936999	853671	83327	920050	56
5	392070	936316	852865	83451	919936	55
6	392337	935634	852058	83575	919821	54
7	392605	934952	851252	83699	919707	53
8	392872	934271	850447	83824	919593	52
9	393140	93359	849642	63948	919479	51
10	393407	932910	848837	84073	919364	50
11	393675	932230	848033	84197	919250	49
12	393942	931552	847230	84322	919135	48
13	394209	630873	846426	84447	919021	47
14	394477	930195	845624	84572	918906	46
15	394744	929518	844821	84696	918791	45
16	395011	928841	844019	84821	918675	44
17	395278	928165	843218	84947	918561	43
18	395546	927489	842417	85072	918446	42
19	395813	926814	841617	85197	918331	41
20	396080	926139	840817	85322	918216	40
21	396347	925465	840017	85448	918101	39
22	396614	924791	839218	85574	917986	38
23	396881	924118	838419	85699	917870	37
24	397148	923446	837621	85825	917755	36
25	397415	922774	836823	85951	917639	35
26	397682	922103	836026	86077	917523	34
27	397949	921432	835229	86203	917408	33
28	398215	920761	834432	86329	917292	32
29	398482	920092	833636	86456	917176	31
30	398749	919423	832840	86582	917060	30

Min.

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Deg. 23 +1-

m	Sines.	Logarit.	Differē.	Logarit.	Sines.
30	378749	919423	832840	86582	917060
31	399016	918754	832015	86709	916944
32	339283	918006	831250	86836	916828
33	399549	917418	830456	86962	916712
34	399816	916751	829662	87089	916595
35	400082	916082	828868	87216	916497
36	400349	915418	828075	87343	916363
37	400616	914753	827283	87470	916246
38	400882	914083	826490	87597	916130
39	401149	913423	825699	87725	916013
40	401415	912759	824907	87852	915896
41	401681	912096	824116	87979	915780
42	401948	911433	823326	88107	915663
43	402214	910771	822536	88235	915546
44	402480	910109	821746	88362	915429
45	402647	909447	820957	88490	915311
46	403013	908786	820163	88619	915194
47	403279	908126	819379	88747	915077
48	403545	907466	818591	88875	914960
49	403811	906807	817804	89003	914842
50	404078	906148	817016	89132	914725
51	404344	905490	816229	89261	914607
52	404610	904832	815443	89389	914489
53	404876	904175	814657	89518	914372
54	405142	903518	813871	89647	914254
55	405407	902862	813086	89776	914136
56	405673	902207	812301	89905	914018
57	405939	901551	811517	90034	913900
58	406205	900897	810733	90163	913782
59	406471	900242	809950	90293	913664
60	406737	899589	809167	90422	913545

Min.

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Deg. 24 +1—

m.	Sines.	Logarit.	Differē.	Logarit	Sines.	m
0	406737	899589	809167	90422	913545	60
1	407001	898936	808384	90552	913427	59
2	407268	898283	807602	90681	913309	58
3	407534	897631	806820	90811	913190	57
4	407799	896980	806039	90941	913072	56
5	408065	896329	805258	91071	912953	55
6	408330	895678	804477	91201	912834	54
7	408596	895028	803697	91331	912715	53
8	408861	894378	802917	91461	912596	52
9	409127	893729	802138	91592	912477	51
10	409392	893081	801358	91722	912358	50
11	409658	892433	800580	91852	912239	49
12	409923	891785	799802	91984	912120	48
13	410188	891138	799024	92114	912001	47
14	410454	890492	798247	92245	911881	46
15	410719	889846	797470	92376	911762	45
16	410984	889200	796693	92507	911642	44
17	411249	888555	795917	92639	911523	43
18	411514	887911	795141	92770	911403	42
19	411779	887267	794366	92901	911283	41
20	412045	886623	793591	93033	911164	40
21	412309	885980	792816	93164	911044	39
22	412575	885338	792042	93296	910924	38
23	412839	884696	791268	93428	910804	37
24	413104	884054	790495	93560	910684	36
25	413369	883413	789722	93692	910563	35
26	413634	882773	788949	93824	910443	34
27	413898	882133	788177	93956	910323	33
28	414164	881493	787405	94088	910202	32
29	414428	880854	786634	94221	910082	31
30	414693	880216	785863	94353	909961	30

M

Deg. 65

Deg. 24 +1-

m	Sines.	Logarit	Differē.	Logarit.	Sines.	
60	30 414693	880216	785863	94353	909961	30
59	31 414958	879578	785092	94486	909841	29
58	32 415223	878940	784322	94618	909720	28
57	33 415487	878303	783552	94751	909599	27
56	34 415752	877667	782782	94884	909478	26
55	35 416016	877031	782013	95017	909357	25
54	36 416281	876396	781246	95150	909236	24
53	37 416545	875760	780476	95283	909115	23
52	38 416810	875125	779708	95417	908994	22
51	39 417074	874492	778941	95550	908873	21
50	40 417338	873857	778174	95684	908751	20
49	41 417603	873224	777407	95818	908630	19
48	42 417867	872592	776640	95951	908508	18
37	43 418131	871959	775874	96085	908389	17
46	44 418395	871328	775108	96119	908265	16
45	45 418660	870696	774343	96353	908143	15
44	46 418924	870066	773578	96487	908021	14
43	47 419188	869435	772814	66622	907899	13
42	48 519452	868806	772050	96756	907777	12
41	49 419716	868176	771286	66890	907655	11
40	50 419980	867547	770523	97025	907533	10
39	51 420244	866919	769760	97159	907411	9
38	52 420508	866291	768997	97295	907289	8
37	53 420772	865664	768235	97429	907166	7
36	54 421036	865037	767473	97564	907044	6
35	55 421300	864411	766711	97699	906922	5
34	56 421563	863785	765950	97834	906799	4
33	57 421827	863159	765189	97970	906676	3
32	58 422091	862534	765429	98105	906553	2
31	59 422355	861910	763669	98241	906431	1
30	60 422618	861286	762909	98376	906308	0

Min

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Deg. 25 +1—

m.	Sines.	Logarit	Differē	Logarit	Sines
0	422618	861286	752909	98376	90630860
1	422882	860662	762150	98512	90618559
2	423145	860039	761391	98648	90606258
3	423409	859416	760633	98784	90593957
4	423672	858794	759874	98920	90581556
5	423936	858172	759117	99056	90569255
6	424199	857551	758359	99192	90556954
7	424463	856931	757602	99328	90544553
8	424726	856310	756846	99465	90532252
9	424989	855690	756089	99601	90519851
10	425253	855071	755333	99738	90507550
11	425516	854452	754578	99875	90495149
12	425779	853834	753822	100012	90482748
13	426042	853216	753067	100149	90470337
14	426306	852598	752313	100286	90457946
15	426569	851981	751559	100423	90445545
16	426832	851365	750805	100560	90433144
17	427095	850749	750052	100697	90420743
18	427358	850133	749299	100835	90408342
19	427621	849518	748546	100972	90395941
20	427884	848902	747794	101110	90383540
21	428147	848289	747042	101247	90371139
22	428410	847675	746290	101385	90358738
23	428672	847062	745539	101523	90346337
24	428935	846449	744788	101661	90333936
25	429198	845837	744037	101799	90321535
26	429461	845225	743287	101938	90309134
27	429723	844613	742537	102076	90296733
28	429986	844002	741788	102215	90284332
29	430248	843391	741039	102353	90271931
30	430511	842782	740290	102492	90259530

M.D.

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Deg. 25 +1-

m.	Sines.	Logarith.	Differe.	Logarith.	Sines.
30	430511	842782	740290	102492	902585
31	430774	842172	739541	102631	902460
32	431036	841563	738793	102770	902335
33	431299	840954	738046	102909	902209
34	431561	840346	737298	103048	902084
35	431823	839738	736551	103187	901958
36	432086	839131	735804	103326	901833
37	432348	838524	735058	103466	901707
38	432610	837917	734312	103605	901581
39	432873	837311	733566	103745	901455
40	433135	836706	732821	103885	901329
41	433397	836101	732076	104025	901203
42	433659	835496	731332	104165	901077
43	433921	834892	730587	104305	900951
44	434183	834288	729843	104445	900824
45	434445	833685	729100	104585	900698
46	434707	833082	728357	104726	900572
47	434969	832480	727614	104866	900445
48	435231	831878	726871	105006	900319
49	435493	831276	726129	105147	900192
50	435755	830675	725387	105288	900065
51	436017	830075	724646	105429	899939
52	436278	829474	723905	105570	899812
53	436540	828875	723164	105711	899685
54	436802	828275	722423	105852	899558
55	437063	827676	721683	105993	899431
56	437325	827070	720943	106135	899303
57	437587	826488	720204	106276	899176
58	437848	825833	719465	106418	899049
59	438110	825255	718726	106559	898921
60	438371	824682	717987	106701	898795

Min.

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Deg. 26 +1—

mi	Sines.	Logarit.	Differen	Logarit.	Sines.
0	438371	824689	717987	106701	89879460
1	438633	824093	717249	106843	89866659
2	438894	823497	716511	106985	89853958
3	439155	822902	715774	107128	89841157
4	439417	822307	715037	107270	89828356
5	439678	821712	714300	107412	89815555
6	439939	821118	713564	107555	89802854
7	440200	820525	712828	107697	89790053
8	440462	819932	712092	107840	89777152
9	440723	819339	711357	107982	89764351
10	440984	818747	710622	108125	89751550
11	441245	818155	709887	108268	89738749
12	441506	817564	709152	108411	89725848
13	441767	816973	708418	108555	89713047
14	442028	816382	707684	108698	89700146
15	442289	815792	706951	108841	89687355
16	442550	815203	706218	108985	89674444
17	442810	814613	705485	109128	89661543
18	443071	814025	704753	109272	89648642
19	443332	813436	704020	109416	89635741
20	443593	812848	703289	109560	89622840
21	443853	812261	702557	109704	89609939
22	444114	811674	701826	109848	89597038
23	444375	811087	701095	109992	89584137
24	444635	810501	700365	110136	89571236
25	444896	809915	699634	110281	89558235
26	445156	809330	698904	110425	89545334
27	445417	808745	698175	110570	89532333
28	445677	808160	697446	110714	89519432
29	445937	807576	696717	110860	89506431
30	446198	806993	695988	111005	89493430

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Deg. 26 + | -

m.	Sines.	Logarit.	Differē.	Logarit.	Sines.
30	446198	806993	695988	111005	894934
31	446458	806409	695260	111150	894804
32	446718	805827	694532	111295	894675
33	446977	805244	693804	111440	894545
34	447238	804662	693076	111586	894415
35	447499	804081	692349	111731	894284
36	447759	803500	691623	111877	894154
37	448019	802919	690896	112022	894024
38	448279	802339	690170	112168	893894
39	448539	801759	689445	112314	893763
40	448799	801179	688719	112460	893633
41	449059	800600	687994	112607	893502
42	449319	800022	687269	112753	893372
43	449579	799444	686544	112899	893240
44	449839	798866	685820	113046	893110
45	450098	798289	685096	113192	892975
46	450358	797712	684373	113339	892848
47	450618	797135	683649	113486	892717
48	450878	796559	682926	113633	892586
49	451137	795983	682204	113780	892455
50	451397	795408	681482	113927	892323
51	451656	794833	680760	114074	892192
52	451916	794259	680038	114221	892061
53	452175	793685	679317	114368	891929
54	452435	793111	678595	114516	891798
55	452694	792538	677875	114664	891666
56	452953	791965	677154	114811	891534
57	453213	791393	676434	114959	891402
58	453472	790821	675714	115107	891270
59	453731	790250	674994	115255	891138
60	453990	789679	674275	115403	891006

Min.

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Deg. 27 +1—

mi.	Sines.	Logarit.	Differen	Logarit.	Sines.
0	453998	789679	674275	115403	89100660
1	454250	789108	673556	115552	89087459
2	454509	788538	772837	115700	89074258
3	454768	787968	672119	115849	89061057
4	454027	787398	671401	115997	89047856
5	455286	786829	670683	116146	89034655
6	455545	786260	669966	116295	89021454
7	455804	785692	669249	116444	89008253
8	456063	785124	668532	116593	88995052
9	456322	784557	667815	116742	88981851
10	456580	783990	667099	116891	88968650
11	455839	783423	666383	117040	88955449
12	457098	782857	665668	117190	88942248
13	457357	782291	664952	117339	88929047
14	457615	781726	664237	117489	88915846
15	457874	781161	663522	117639	88902645
16	458132	780596	662808	117788	88889444
17	458391	780032	662094	117938	88876243
18	458650	779468	661380	118089	88863042
19	458908	778905	660666	118239	88849841
20	459166	778342	659953	118389	88836640
21	459425	777780	659240	118539	88823439
22	459683	777218	658528	118690	88810238
23	459942	776656	657815	118841	88797037
24	460200	776094	657103	118991	88783836
25	460458	775533	656391	119142	88770635
26	460716	774973	655680	119293	88757434
27	460974	774412	654968	119444	88744233
28	461232	773853	654257	119595	88731032
29	461491	773293	653547	119747	88717831
30	461749	772734	652836	119898	88704630

Min.

Deg. 62

Deg. 27

+ 22

	Sines.	Logarithm.	Differen.	Logarit.	Sines.	
30	461747	772734	652836	119898	887011	30
31	461007	772176	652126	120050	886877	29
32	462165	771617	651416	120203	886742	28
33	462522	771060	650707	120353	886608	27
34	462780	770502	649997	120505	886473	26
35	463038	769945	649289	120657	886338	25
36	463296	769389	648580	120809	886203	24
37	463554	768832	647872	120961	886069	23
38	463811	768277	647164	121113	885934	22
39	464069	767721	646456	121265	885799	21
40	464327	767166	645748	121418	885664	20
41	464584	766612	645041	121570	885529	19
42	464842	766057	644334	121723	885394	18
43	465099	765503	643628	121876	885258	17
44	465357	764950	642921	122029	885123	16
45	465614	764397	642215	122182	884988	15
46	465872	763844	641509	122335	884852	14
47	466129	763292	640804	122488	884716	13
48	466387	762740	640099	122641	884581	12
49	466644	762188	639394	122795	884445	11
50	466901	761637	638689	122948	884309	10
51	467158	761087	637985	123102	884174	9
52	467416	760536	637280	123255	884038	8
53	467673	759986	636577	123409	883902	7
54	467930	759437	635873	123563	883766	6
55	468187	758887	635170	123717	883629	5
56	468444	758339	634467	123871	883493	4
57	468701	757790	633764	124026	883357	3
58	468958	757242	633062	124180	883220	2
59	469215	756694	632360	124335	883084	1
60	469472	756147	631658	124489	882948	0

M. n.

H

Deg. 62

Deg. 28 +

m.	Sines.	Logarith.	Differen.	Logarit.	Sines.
0	469472	756147	631658	124489	882948
1	469728	755600	630956	124644	882811
2	469985	755054	630255	124799	882674
3	470242	754508	629553	124954	882537
4	470499	653962	628853	125109	882401
5	470755	753416	628152	125264	882264
6	471012	752871	627452	125420	882127
7	471268	752327	626752	125575	881990
8	471525	751783	626052	125730	881853
9	471781	751239	625353	125886	881715
10	472038	750695	624654	126042	881578
11	472294	750152	623955	126197	881441
12	472551	749610	623256	126353	881303
13	472807	749067	622558	126509	881166
14	473063	748525	621860	126665	881028
15	473320	747984	621162	126822	880891
16	473576	747443	620465	126978	880753
17	473832	746902	619768	127134	880615
18	474088	746362	619071	127291	880477
19	474344	745822	618374	127448	880339
20	474600	745282	617677	127604	880201
21	474856	744743	616981	127761	880063
22	475112	744204	616285	127918	879925
23	475368	743665	615590	128075	879787
24	475624	743127	614894	128233	879649
25	475880	742589	614199	128390	879510
26	476136	742052	613506	128547	879371
27	476392	741515	612810	128705	879233
28	476647	740978	612115	128863	879095
29	476907	740443	611421	129020	878956
30	477159	739906	610727	129178	878817

Min.

Deg. 61

Deg. 28 + —

	Sines.	Logarith	Differen	Logarit.	Sines	
30	477159	739906	610727	129178	878817	30
31	477414	739370	610034	129336	878678	29
32	477670	738835	609340	129494	878539	28
33	477925	738300	608647	129653	878400	27
34	478181	737766	608955	129811	878261	26
35	478436	737232	607262	129969	878122	25
36	478692	736698	606570	130128	877983	24
37	478947	736165	605878	130286	877844	23
38	479203	735632	605186	130445	877704	22
39	479458	735099	604495	130604	877565	21
40	479713	734567	603804	130763	877425	20
41	479968	734035	603113	130922	877286	19
42	480224	733503	602422	131081	877146	18
43	480479	732972	601731	131241	877006	17
44	480734	732441	601041	131400	876867	16
45	480989	731911	600351	131560	876727	15
46	481244	731381	599662	131719	876587	14
47	481499	730851	598972	131879	876447	13
48	481754	730322	598283	132039	876307	12
49	482009	729793	597594	132199	876166	11
50	482263	729264	596906	132359	876026	10
51	482518	728736	596217	132519	875886	9
52	482773	728208	595529	132680	875746	8
53	483028	727681	594841	132840	875605	7
54	483282	727154	594153	133000	875465	6
55	483537	726627	593466	133161	875324	5
56	483792	726101	592779	133322	875183	4
57	484046	725575	592092	133483	875042	3
58	484301	725049	591405	133644	874902	2
59	484555	724524	590719	133805	874761	1
60	484810	723999	590033	133966	874620	0

Min.

H 1

Deg. 61

Deg. 29

+1-

m.	Sines	Logarith	Differen	Logarit	Sines
0	484810	723999	590033	133966	375620 60
1	485064	723474	589347	134127	374479 59
2	485318	722950	588661	134289	374338 58
3	485573	722426	587976	134450	374196 57
4	485827	921903	587291	134612	374055 56
5	486081	721379	586606	134774	373914 55
6	486335	720857	585921	134935	373772 54
7	486589	720334	585237	135097	373631 53
8	486844	719812	584553	135259	373489 52
9	487098	719290	583869	135422	373347 51
10	487352	718769	583185	135584	373206 50
11	487606	718248	582501	135746	373064 49
12	487860	717727	581818	135909	372922 48
13	488113	717207	581135	135071	372780 47
14	488367	716687	580453	136234	372638 46
15	488621	716167	579770	136397	372496 45
16	488875	715648	579088	136560	372354 44
17	489129	715129	578406	136723	372212 43
18	489382	714611	577724	136886	372069 42
19	489636	714092	577043	137050	371927 41
20	489890	713575	576361	137213	371784 40
21	490143	713057	575681	137377	371642 39
22	490397	712540	575000	137540	371499 38
23	490650	712023	574319	137704	371356 37
24	490904	711507	573639	137868	371214 36
25	491157	710991	572959	138032	371071 35
26	491410	710475	572279	138196	370928 34
27	491664	709960	571600	138360	370785 33
28	491917	709445	570920	138524	370642 32
29	492170	708930	570241	138689	370499 31
30	492423	708416	569562	138853	370356 30

Min.

Deg. 60

Deg. 29 +

m.	Sines.	Logarith.	Differen.	Logarith.	Sines.
30	492423	708416	569562	138853	87035630
31	492677	707902	568884	139018	87021229
32	492930	707388	568206	139183	87006928
33	493183	706875	567527	139347	86992627
34	493436	706362	566850	139512	86978226
35	493689	705849	566172	139677	86963925
36	493942	705337	565494	139843	86949524
37	494195	704825	564817	140008	86935123
38	494448	704314	564140	140173	86920722
39	494700	703803	563464	140339	86906421
40	494953	703292	562787	140504	86892020
41	495206	702781	562111	140670	86877619
42	495459	702271	561435	140836	86863218
43	495711	701761	560759	141002	86848717
44	495965	701252	560084	141168	86834316
45	496216	700743	559408	141334	86819915
46	496469	700234	558733	141500	86805414
47	496721	699726	558059	141667	86791013
48	496974	699218	557384	141834	86776512
49	497226	698710	556709	142000	86762011
50	497479	698202	556035	142167	86747610
51	497731	697695	555361	142334	8673319
52	497983	697189	554687	142501	8671878
53	498236	696682	554014	142668	8670427
54	498488	696176	553345	142835	8668976
55	498740	695670	552668	143003	8667525
56	498992	695165	551995	143170	8666074
57	499244	694660	551322	143338	8664613
58	499496	694155	550650	143505	8663162
59	499748	693651	550978	143673	8661711
60	500000	693147	549306	143841	8660250

M17.

Deg. 30

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m.	Sines	Logarith.	Diff.	Logarith.	Sines
0	500000	693147	549306	143841	866025
1	500252	692643	548634	144009	865880
2	500504	692140	547963	144177	865734
3	500756	691637	547292	144345	865589
4	501007	691134	546621	144514	865443
5	501259	690632	545950	144682	865297
6	501510	690130	545279	144851	865151
7	501762	689628	544609	145019	865005
8	502014	689127	543939	145188	864859
9	502266	688626	543269	145357	864713
10	502517	688125	542599	145526	864567
11	502769	687625	541930	145695	864421
12	503020	687125	541260	145864	864275
13	503271	686625	540591	146034	864128
14	503523	686126	539923	146203	863982
15	503774	685627	539254	146373	863835
16	504025	685128	538586	146543	863689
17	504276	684630	537918	146712	863542
18	504528	684132	537250	146882	863396
19	504779	683635	536582	147052	863249
20	505030	683137	535915	147223	863102
21	505281	682640	535247	147393	862955
22	505532	682144	534580	147563	862808
23	505783	681648	533914	147734	862661
24	506034	681152	533247	147904	862514
25	506285	680656	532581	148075	862366
26	506535	680161	431915	148246	862219
27	506786	679666	531249	148417	862072
28	507037	679171	530583	148588	861924
29	507288	678677	529918	148759	861777
30	507538	678183	529252	148930	861629

Min.

Deg. 59

Deg. 30

+1-

12 300

m.	Sines	Logarith.	Differen	Logarith	Sines
30	507538	678163	529252	148930	861619
31	507789	677689	528587	149102	861481
32	508040	677196	527922	149273	861334
33	508290	676703	527258	149445	861186
34	508541	676210	526593	149616	861038
35	508791	675717	525929	149788	860890
36	509041	675225	525265	149960	860742
37	509292	674734	524601	150132	860594
38	509542	674242	523938	150305	860446
39	509792	673751	523274	150477	860297
40	510043	673261	522611	150649	860149
41	510293	672770	521948	150822	860001
42	510543	672280	521285	150995	859852
43	510793	671790	520623	151167	859704
44	511043	671301	519961	151340	859555
45	511293	670812	519299	151513	859406
46	511543	670323	518637	151686	859258
47	511793	669835	517975	151860	859109
48	512043	669347	517314	152033	858960
49	512293	668859	516652	152206	858811
50	512542	668371	515991	152380	858662
51	512792	667884	515330	152554	858513
52	513042	667397	514670	152727	858363
53	513292	666911	514009	152901	858214
54	513541	666425	513349	153075	858065
55	513791	665939	512689	153250	857915
56	514040	665453	512029	153424	857766
57	514290	664968	511370	153598	857616
58	514539	664483	510710	153773	857467
59	514789	663998	510051	153947	857317
60	515038	663514	509392	154122	857167

Min.

H 4

Deg. 59

Deg. 31

+1-

m	Sines	Logarith.	Differen.	Logarit.	Sines	m
0	515038	663514	509392	154122	85716760	30
1	5151287	663030	508733	154297	85701759	31
2	515537	662546	508074	154472	85686858	32
3	515786	662063	507416	154647	85671857	33
4	516035	661580	506758	154822	85656856	34
5	516284	661097	506100	154998	85641855	35
6	516533	660615	505442	155173	85626854	36
7	516782	660133	504784	155348	85611853	37
8	517031	659651	504127	155524	85596852	38
9	517280	659170	503470	155700	85581851	39
10	517529	658689	502813	155876	85566850	40
11	517778	658208	502156	156052	85551849	41
12	518027	657727	501500	156228	85536848	42
13	518276	657247	500843	156404	85521847	43
14	518525	656768	500187	156580	85506846	44
15	518773	656288	499531	156757	85491845	45
16	519022	655809	498875	156933	85476844	46
17	519271	655330	498220	157110	85461843	47
18	519519	654851	497564	157287	85446842	48
19	519767	654373	496909	157464	85431841	49
20	520016	653895	496254	157641	85416840	50
21	520265	653417	495599	157818	85401839	51
22	520513	652940	494945	157995	85386838	52
23	520761	652463	494290	158172	85371837	53
24	521010	651986	493636	158350	85356836	54
25	521258	651510	492982	158528	85341835	55
26	521506	651034	492328	158705	85326834	56
27	521754	650558	491675	158883	85311833	57
28	522002	650083	491021	159061	85296832	58
29	522251	649607	490368	159239	85281831	59
30	522499	649133	489715	159418	85266830	60

ALM.

Deg. 58

Deg. 31 +1-

m	Sines.	Logarith.	Differen.	Logarit.	Sines.
30	522499	649133	489715	159418	852640
31	522747	648638	489062	159596	852488
32	522995	648184	488410	159774	852336
33	523242	647710	487757	159953	852184
34	523490	647237	487105	160132	852032
35	523738	646763	486753	160310	851879
36	523980	646290	485801	160489	851727
37	524234	645818	485149	160668	851574
38	524481	645345	484493	160847	851422
39	524729	644873	483846	161027	851269
40	524977	644401	483195	161206	851117
41	525224	643930	482544	161385	850964
42	525472	643459	481894	161565	850811
43	525719	642938	481243	161745	850658
44	525966	642517	480593	161925	850505
45	526214	642047	479943	162105	850352
46	526461	641577	479293	162285	850199
47	526708	641108	478641	162465	850046
48	526956	640638	477993	162645	849893
49	527203	640169	477344	162816	849739
50	527450	639701	476695	163006	849586
51	527697	639232	476046	163187	849433
52	527944	638764	475397	163368	849279
53	528191	638296	474748	163548	849125
54	528438	637829	474099	163729	848972
55	528685	637362	473451	163911	848818
56	528932	636895	472803	164092	848664
57	529179	636428	472155	164273	848510
58	529426	635962	471507	164455	848356
59	529672	635496	470860	164636	848202
60	529919	635030	470213	164818	848048

Mis.

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Deg. 38

Deg. 32

+ | -

<i>M. Sines</i>	<i>Logarith.</i>	<i>Differen.</i>	<i>Logarit.</i>	<i>Sines.</i>
0 529919	635030	470212	164818	848048 60
1 530166	634565	469564	165000	847894 59
2 530412	634100	468919	165182	847730 58
3 530659	633635	468272	165364	847585 57
4 530906	633171	467624	165546	847431 56
5 531152	632706	466978	165728	847276 55
6 531398	632243	466332	165911	847122 54
7 531645	631779	465686	166093	846967 53
8 531891	631316	465040	166276	846813 52
9 532138	630853	464394	166458	846658 51
10 532384	630390	463749	166641	846503 50
11 532630	629928	463103	166824	846348 49
12 532876	629466	462458	167007	846193 48
13 533122	629004	461813	167191	846038 47
14 533368	628542	461168	167374	845883 46
15 533614	628081	460523	167558	845728 45
16 533860	627620	459879	167741	845572 44
17 534106	627160	459235	167925	845417 43
18 534352	626700	458590	168109	845262 42
19 534598	626239	457947	168293	845106 41
20 534844	625780	457303	168477	844951 40
21 535090	625320	456659	168661	844795 39
22 535335	624861	456016	168845	844640 38
23 535581	624402	455373	169030	844484 37
24 535827	623944	454730	169214	844328 36
25 536072	623486	454086	169399	844172 35
26 536318	623028	453444	169584	844016 34
27 536563	622570	452801	169768	843860 33
28 536809	622113	452159	169953	843704 32
29 537054	621656	451517	170139	843548 31
30 537300	621199	450875	170324	842391 30

Min.

Deg. 57

Deg. 32

+1-

mi	Sines	Logarith.	Differen.	Logarit.	Sines
30	537300	621199	450875	170324	843391
31	537545	620743	450233	170509	843235
32	537790	620286	449592	170695	843079
33	538035	619831	448950	170880	842922
34	538281	619375	448309	171066	842766
35	538526	618920	447668	171252	842609
36	538771	618465	447027	171438	842452
37	539016	618010	446386	171624	842296
38	539261	617556	445745	171810	842139
39	539500	617101	445105	171997	841982
40	539751	616648	444465	172183	841825
41	539985	616194	443824	172370	841666
42	540240	615741	443184	172556	841511
43	540485	615288	442545	172743	841354
44	540730	614835	441905	172930	841196
45	540974	614383	441266	173117	841039
46	541219	613931	440626	173304	841882
47	541464	613479	439988	173492	840724
48	541708	613027	439348	173679	840567
49	541953	612576	438710	173867	840409
50	542197	612125	438071	174054	840251
51	542442	611675	437433	174242	840093
52	542686	611224	436794	174430	839936
53	542930	610774	436156	174618	839778
54	543174	610325	435519	174806	839620
55	543419	609875	434881	174994	839462
56	543663	609426	434243	175183	839304
57	543907	608977	433606	175371	839146
58	544151	608528	432969	175560	838987
59	544405	608080	432332	175748	838829
60	544659	607632	431695	175937	838671

Min.

Deg. 57

Deg. 33

Min.	Sines	Logarith.	Differen.	Logarit.	Sines.	Min.
0	544639	607631	431695	75937	838671	60
1	544883	607184	431058	76126	838512	59
2	545127	606737	430421	76315	838354	58
3	545371	606289	429785	76504	838195	57
4	545614	605842	429149	76694	838036	56
5	545858	605396	428513	76883	837878	55
6	546102	604949	427877	77073	837719	54
7	546346	604503	427241	77262	837560	53
8	546580	604057	426605	77452	837401	52
9	546833	603612	425970	77642	837242	51
10	547076	603167	425335	77832	837083	50
11	547320	602722	424699	78022	836924	49
12	547563	602277	424064	78213	836764	48
13	547807	601833	423430	78403	836605	47
14	548050	601389	422795	78594	836446	46
15	548293	600945	422160	78784	836286	45
16	548536	600501	421526	78975	836127	44
17	548780	600058	420892	79166	835967	43
18	549023	599615	420258	79357	835807	42
19	549266	599172	419624	79548	835648	41
20	549509	598730	418990	79739	835488	40
21	549752	598283	418357	79931	835328	39
22	549995	597846	417724	80122	835168	38
23	550238	597401	417090	80314	835008	37
24	550481	596963	416457	80506	834848	36
25	550724	596522	415824	80698	834688	35
26	550966	596081	415192	80890	834527	34
27	551209	595641	414559	81082	834367	33
28	551452	595201	413927	81274	834207	32
29	551694	594761	413294	81466	834046	31
30	551937	594311	412662	81659	833886	30

21 m.

Deg. 56

Deg. 33 +

M	Sines	Logarit	Differē.	Logarit.	Sines
30	551937	594341	412662	181659	833886
31	552179	593883	412031	181851	833725
32	552422	593444	411400	182044	833565
33	552664	593005	410768	182237	833404
34	552907	592566	410137	182430	833243
35	553149	592127	409504	182623	833082
36	553392	591689	408873	182816	832921
37	553634	591252	408242	183009	832760
38	553876	590814	407611	183203	832599
39	554118	590377	406980	183396	832438
40	554360	589940	406350	183590	832277
41	554602	589504	405720	183784	832115
42	554844	589067	405089	183978	831954
43	555086	588631	404459	184172	831793
44	555328	588195	403829	184366	831631
45	555570	587760	403200	184560	831470
46	555812	587325	402570	184755	831308
47	556054	586890	401940	184949	831146
48	556296	586455	401311	185144	830984
49	556537	586021	400682	185339	830823
50	556779	585587	400053	185534	830661
51	557021	585153	399424	185729	830499
52	557262	584719	398795	185924	830337
53	557504	584286	398167	186119	830175
54	557745	583853	397538	186315	830012
55	557987	583420	396910	186510	829850
56	558228	582988	396282	186706	829688
57	558469	582556	395654	186902	829525
58	558711	582123	395026	187098	829363
59	558952	581692	394398	187294	829200
60	559193	581261	393771	187490	829038

Min.

Deg. 56

Deg. 34 +1-

m	Sines	Logarith	D ff. e	Logarith	Sines
0	559193	581261	393771	18749	829038
1	559434	580829	393142	187686	828879
2	559675	580399	392516	187832	828712
3	559916	579968	391889	188079	828549
4	560157	579538	391262	188275	828386
5	560398	579108	390635	188472	828222
6	560639	578678	390009	188669	828060
7	560880	578248	389382	188866	827897
8	561121	577819	388756	189063	827734
9	561361	577390	388130	189260	827571
10	561602	576961	387504	189458	827407
11	561843	576533	386878	189655	827244
12	562083	576105	386252	189853	827081
13	562324	575677	385626	190051	826917
14	562564	575249	385001	190249	826753
15	562805	574822	384375	190447	826590
16	563025	574395	383750	190645	826426
17	563286	573968	383125	190843	826262
18	563526	573541	382500	191041	826098
19	563766	573115	381875	191240	825934
20	564007	572689	381250	191439	825770
21	564247	572263	380626	191637	825606
22	564487	571838	380002	191836	825442
23	564727	571413	379377	192035	825278
24	564967	570988	378754	192234	825114
25	565207	570563	378130	192433	824949
26	565447	570139	377506	192633	824785
27	565687	569714	376882	192832	824620
28	565927	569291	376259	193032	824456
29	566166	568867	375635	193232	824291
30	566406	568444	375012	193431	824126

Mill.

Deg. 55

Deg. 34 +1—

m.	Sines	Logarit.	Differe.	Logarit.	Sines.
30	566406	568444	375012	193414	824126
31	566646	568920	374389	193631	823961
32	566886	569398	373766	193831	823796
33	567126	569875	373143	194032	823632
34	567365	569353	372521	194232	823467
35	567604	569831	371898	194433	823301
36	567844	569309	371276	194633	823136
37	568083	569787	370653	194834	822971
38	568323	569266	370031	195035	822806
39	568562	569745	369409	195236	822640
40	568801	569224	368787	195437	822475
41	569040	569704	368165	195638	822310
42	569280	569183	367544	195840	822144
43	569519	569663	366922	196041	821978
44	569758	569144	366301	196243	821813
45	569997	569624	365680	196444	821647
46	570236	569105	365059	196646	821481
47	570475	569586	364438	196848	821315
48	570714	569068	363817	197051	821149
49	570952	569549	363196	197253	820983
50	571191	569031	362576	197455	820817
51	571429	569513	361956	197657	820651
52	571669	569996	361335	197860	820485
53	571907	569478	360715	198063	820318
54	572146	569961	360095	198266	820152
55	572384	569444	359476	198469	819985
56	572623	569928	358856	198672	819819
57	572861	569411	358236	198875	819652
58	573100	569895	357617	199078	819485
59	573338	569379	356998	199282	819319
60	573576	569864	356378	199485	819152

Min.

Deg. 55

Deg. 35

m.	Sines	Logarit	Differē	Logarit	Sines.
0	573576	555864	356373	199485	319152
1	573815	555449	355759	199589	318935
2	574053	555034	355140	199863	318818
3	574291	554619	354522	200097	318651
4	574529	554204	353903	200301	318484
5	574767	553790	353285	200505	318317
6	575005	553376	352656	200710	318151
7	575243	552962	352048	200914	317982
8	575481	552549	351430	201119	317815
9	575719	552135	350812	201324	317648
10	575957	551722	350194	201528	317480
11	576195	551310	349576	201733	317313
12	576432	550897	348958	201939	317145
13	576670	550485	348341	202144	316977
14	576908	550073	347724	202349	316809
15	577145	549661	347106	202555	316642
16	577383	549250	346489	202760	316474
17	577620	548838	345872	202966	316306
18	577858	548427	345255	203171	316138
19	578095	548017	344639	203378	315969
20	578332	547606	344022	203584	315801
21	578570	547196	343405	203791	315633
22	578807	546786	342789	203997	315465
23	579044	546376	342173	204204	315296
24	579281	545967	341557	204410	315128
25	579518	545558	340941	204617	314959
26	579755	545148	340325	204824	314791
27	579992	544740	339709	205031	314622
28	580229	544332	339093	205238	314453
29	580466	543923	338478	205446	314284
30	580703	543516	337863	205653	314115

min.

Deg. 54

Deg. 35 + 12

m	Sines	Logarit.	Differē.	Logarit.	Sines.	
30	580703	543516	337363	205653	814115	30
31	580940	543108	337247	205861	913946	29
32	581177	542700	336642	206068	813777	28
33	581413	542293	336017	206276	813608	27
34	581650	541886	335402	206484	813439	26
35	581886	541480	334788	206692	813270	25
36	582123	541073	334173	206900	813101	24
37	582359	540667	333559	207108	812931	23
38	582596	540261	332944	207317	812762	22
39	582832	539855	332330	207525	812592	21
40	583069	539450	331716	207734	812423	20
41	583305	539045	331102	207943	812253	19
42	583541	538640	330488	208152	812083	18
43	583777	538235	329874	208361	811914	17
44	584014	537831	329260	208570	811744	16
45	584250	537427	328647	208780	811574	15
46	584486	537023	328033	208989	811404	14
47	584722	536619	327420	209199	811234	13
48	584958	536215	326807	209408	811064	12
49	585194	535812	326193	209618	810894	11
50	585429	535409	325581	209828	810723	10
51	585665	535007	324968	210038	810553	9
52	585901	534604	324356	210249	810483	8
53	586137	534202	323743	210459	810212	7
54	586372	533800	323131	210669	810042	6
55	586608	533398	322518	210880	809871	5
56	586844	532997	321906	211091	809700	4
57	587079	532596	321294	211302	809530	3
58	587314	532195	320682	211513	809359	2
59	587550	531794	320070	211724	809188	1
60	587785	531393	319458	211935	809017	0

Min.

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m.	Sines.	Logarit	Differē	Logarit.	Sines	m.
0	587785	531393	319458	211935	808017	60
1	588020	530993	318846	212147	808946	59
2	588256	530593	318235	212358	808675	58
3	588491	530193	317624	212570	808504	57
4	588726	529794	317012	212782	808333	56
5	588961	529395	316401	212994	808161	55
6	589196	528996	315790	213206	807990	54
7	589431	528597	315179	213418	807818	53
8	589666	528198	314568	213630	807647	52
9	589901	527800	313957	213843	807475	51
10	590136	527402	313347	214055	807304	50
11	590371	527004	312736	214268	807132	49
12	590606	526607	312126	214481	806960	48
13	590840	526209	311515	214694	806788	47
14	591075	525812	310905	214907	806617	46
15	591310	525414	310295	215120	806445	45
16	591544	525019	309685	215333	806273	44
17	591779	524622	309075	215547	806100	43
18	592013	524226	308466	215760	805928	42
19	592248	523830	307856	215974	805756	41
20	592482	523434	307247	216188	805584	40
21	592716	523039	306637	216402	805412	39
22	592950	522644	306028	216611	805239	38
23	593185	522249	305419	216830	805066	37
24	593419	521854	304810	217045	804894	36
25	593653	521460	304201	217259	804721	35
26	593887	521066	303592	217474	804548	34
27	594121	520672	302983	217689	804376	33
28	594355	520278	302375	217904	804203	32
29	594589	519885	301766	218119	804030	31
30	594823	519491	301158	218334	803857	30

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m	Sines.	Logarit.	Differē.	Logarit.	Sines.
30	594823	519492	301158	218334	803857
31	595057	519099	300549	218549	803684
32	595290	518706	299941	218765	803511
33	595524	518313	299333	218980	803337
34	595758	517921	298725	219196	803164
35	595991	517529	298117	219412	802991
36	596225	517137	297509	219628	802817
37	596458	516746	296902	219844	802644
38	596692	516354	296294	220060	802470
39	596925	515963	295687	220276	802297
40	597150	515572	295079	220493	802123
41	597392	515182	294472	220710	801949
42	597625	514791	293865	220926	801776
43	597858	514401	293258	221143	801602
44	598091	514011	292651	221360	801428
45	598325	513622	292044	221577	801254
46	598558	513232	291437	221795	801080
47	598791	512843	290831	222012	800906
48	599024	512454	290224	222230	800731
49	599257	512065	289618	222447	800557
50	599489	511677	289012	222665	800383
51	599722	511289	288406	222883	800208
52	599955	510901	287799	223101	800034
53	600188	510513	28719	223319	799859
54	600420	510125	286588	223538	799685
55	600653	509738	285982	223756	799510
56	600885	509351	285376	223975	799335
57	601118	508964	284771	224193	799160
58	601350	508577	284165	224412	798985
59	601583	508191	283560	224631	798810
60	601815	507805	282954	224851	798635

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m.	Sines.	Logarit.	Diff. re.	Logarit.	Sines.
0	601815	507805	282954	224851	798635
1	602047	507419	282349	225070	798465
2	602280	507033	281744	225289	798285
3	602512	506648	281139	225509	798110
4	602744	506263	280534	225728	797935
5	602976	505878	279929	225948	797759
6	603208	505493	279323	226168	797584
7	603440	505108	278720	226388	797408
8	603672	504724	278116	226608	797233
9	603904	504340	277521	226829	797057
10	604136	503956	276907	227049	796881
11	604367	503573	276303	227270	796706
12	604599	503189	275699	227490	796530
13	604831	502806	275095	227711	796354
14	605062	502423	274491	227932	796178
15	605294	502041	273887	228153	796002
16	605525	501658	273284	228375	795826
17	605757	501276	272680	228596	795650
18	605988	500894	272076	228818	795473
19	606220	500512	271473	229039	795297
20	606451	500131	270870	229261	795121
21	606682	499750	270266	229483	794944
22	606914	499369	269663	229705	794768
23	607145	498988	269060	229928	794591
24	607376	498607	268457	230150	794415
25	607607	498227	267854	230372	794238
26	607838	497847	267252	230595	794061
27	608069	497467	266649	230818	793884
28	608300	497087	266047	231041	793707
29	608531	496708	265444	231263	793530
30	608761	496329	264842	231487	793353

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+-

m.	Sines.	Logarit.	Differen	Logarit.	Sines
30	608761	496329	264842	231487	793353
31	608992	495950	264240	231710	793176
32	609223	495571	263638	231933	792999
33	609454	495192	263036	232157	792822
34	609684	494814	262434	232380	792644
35	609915	494436	261833	232604	792467
36	610145	494058	261230	232828	792290
37	610376	493681	260628	233052	792112
38	610606	493303	260027	233276	791934
39	610836	492926	259425	233501	791757
40	611067	492549	258824	233725	791579
41	611297	492172	258222	233950	791401
42	611527	491796	257621	234175	791223
43	611757	491419	257020	234400	791046
44	611987	491043	256419	234625	790868
45	612217	490668	255818	234850	790690
46	612447	490292	255217	235075	790511
47	612677	489917	254616	235300	790333
48	612907	489542	254016	235526	790155
49	613137	489167	253415	235752	789977
50	613367	488792	252814	235978	789798
51	613596	488418	252214	236204	789620
52	613826	488043	251614	236430	789441
53	614056	487669	251014	236656	789263
54	614285	487296	250413	236882	789084
55	614515	486922	249813	237109	788905
56	614744	486549	249213	237335	788727
57	614975	486176	248614	237561	788548
58	615205	485803	248014	237789	788369
59	615432	485430	247414	238016	788190
60	615661	485058	246814	238243	788011

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mi. Sines.	Logarit.	Differē.	Logarit.	Sines.
0 615661	485058	246814	238243	78801160
1 615891	484686	246215	238471	78783259
2 616120	484314	245615	238699	78765258
3 616349	483942	245016	238926	78747357
4 616578	483570	244417	239153	78729456
5 616807	483199	243817	239381	78711455
6 617026	482828	243218	239609	78693554
7 617265	482457	242619	239838	78675553
8 617494	482086	242020	240066	78657652
9 617722	481716	241421	240294	78639651
10 617951	481346	240823	240523	78621750
11 618180	480976	240224	240751	78603749
12 618408	480606	239625	240980	78585748
13 618637	480236	239027	241209	78567747
14 618866	479867	238428	241438	78549746
15 619094	479498	237830	241668	78531755
16 619322	479129	237232	241897	78513744
17 619551	478760	236633	242127	78495743
18 619779	478392	236035	242356	78477642
19 620007	478024	235437	242586	78459641
20 620236	477656	234840	242816	78441640
21 620464	477288	234242	243046	78423539
22 620692	476920	233644	243276	78405538
23 620920	476553	233046	243507	78387437
24 621148	476186	232449	243737	78369336
25 621376	475819	231851	243968	78351335
26 621604	474452	231254	244199	78333234
27 621831	475086	230656	244429	78315133
28 622059	474720	230059	244660	78297032
29 622287	474354	229461	244892	78278931
30 622515	473988	228865	245123	78260830

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Deg. 38 + —

<i>m.</i>	<i>Sines.</i>	<i>Logarit</i>	<i>Diff.</i>	<i>Logarit.</i>	<i>Sines.</i>
30	622515	473988	228865	245123	782608
31	622742	473622	228268	245354	782427
32	622970	473257	227671	245586	782246
33	623197	472892	227074	245818	782065
34	623425	472527	226477	246050	781883
35	623652	472164	225880	246282	781702
36	623880	471798	225284	246514	781520
37	624107	471434	224688	246746	781339
38	624334	471069	224091	246978	781157
39	624561	470706	223495	247211	780976
40	624788	470341	222898	247444	780764
41	625016	469978	222302	247676	780512
42	625243	469615	221706	247909	780430
43	625469	469252	221110	248143	780248
44	625697	469889	220514	248376	780066
45	625923	468527	219918	248609	779884
46	626150	468164	219322	248843	779702
47	626377	467802	218726	249076	779520
48	626604	467440	218130	249310	779338
49	626830	467979	217534	249544	779156
50	627057	466717	216939	249778	778973
51	627284	466356	216343	250013	778761
52	627510	465995	215748	250247	778608
53	627737	465634	215153	250481	778426
54	627963	465274	214557	250716	778243
55	628189	464913	213962	250951	778060
56	628416	464553	213367	251186	778878
57	628642	464193	212772	251421	777695
58	628868	463833	212177	251656	777512
59	629094	463974	211582	251891	777329
60	629320	463115	210988	252127	776146

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m	Sines.	Logarit.	Differe.	Logarit.	Sines.
0	629320	463115	210988	252127	77714660
1	629546	462755	210393	252363	77696359
2	629772	462397	209798	252598	77678058
3	629998	462038	209204	252834	77659657
4	630124	461679	208609	253070	77641356
5	630450	461321	208015	253306	77623055
6	630676	460963	207420	253543	77604654
7	630902	460605	206826	253779	77586353
8	631127	460248	206232	254016	77567952
9	631353	459890	205638	254253	77549651
10	631578	459533	205043	254489	77531250
11	631804	459176	204449	254726	77512849
12	632029	458819	203855	254964	77494448
13	632155	458463	203262	255201	77476147
14	632480	458106	202668	255438	77457746
15	632705	457750	202074	255676	77439345
16	632930	457394	201481	255914	77420844
17	633156	457039	200887	256152	77402443
18	633381	456683	200293	256390	77384042
19	633606	456328	199700	256628	77365641
20	633831	455973	199107	256866	77347240
21	634056	455618	198513	257105	77328739
22	634281	455263	197920	257343	77310338
23	634506	454909	197327	257582	77291837
24	634731	454555	196734	257821	77273436
25	634955	454201	196141	258060	77254935
26	635180	453847	195548	258299	77236434
27	635405	453493	194955	258538	77217933
28	635629	453140	194362	258778	77199432
29	635854	452787	193769	259017	77181031
30	636078	452434	193177	259257	77162530

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Deg. 39 +

m. Sines.	Logarit.	Differē.	Logarit.	Sines
30 636078	452434	193177	259258	771625 30
31 636303	452081	192584	259497	771439 29
32 636527	451728	191991	259737	771254 28
33 636751	451376	191399	259977	771069 27
34 636976	451024	190806	260217	770884 26
35 637200	450672	190214	260458	770699 25
36 637424	450320	189622	260698	770513 24
37 637648	449968	189029	260939	770328 23
38 637872	449617	188437	261180	770142 22
39 638096	449266	187845	261421	769957 21
40 638320	448915	187253	261662	769771 20
41 638544	448564	186661	261903	769585 19
42 638768	448214	186069	262145	769399 18
43 638992	447864	185477	262386	769214 17
44 639215	447514	184885	262628	769028 16
45 639439	447164	184294	262870	768842 15
46 639663	446814	183702	263112	768655 14
47 639886	446465	183110	263354	768469 13
48 640110	446115	182519	263596	768283 12
49 640333	445766	181928	263838	768097 11
50 640557	445418	181336	264081	767911 10
51 640780	445069	180745	264324	767725 9
52 641003	444721	180154	264567	767538 8
53 641226	444372	179562	264810	767352 7
54 641450	444024	178971	265053	767165 6
55 641673	443677	178380	265296	766979 5
56 641896	443329	177789	265540	766792 4
57 642119	442982	177198	265783	766605 3
58 642342	442634	176607	266027	766418 2
59 642565	442287	176017	266271	766231 1
60 642778	441941	175426	266515	766044 0

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I Deg. 50

Deg. 40



Sines.	Logarith.	Differen	Logarit.	Sines
0 642788	441941	175426	266515	766044 60
1 643010	441594	174835	266759	765857 59
2 643233	441248	174245	267003	765670 58
3 643456	440902	173654	267248	765483 57
4 643678	440556	173064	267492	765296 56
5 643901	440210	172473	267737	765109 55
6 644124	439865	171883	267982	764921 54
7 644346	439519	171293	268227	764734 53
8 644568	439174	170702	268472	764547 52
9 644791	438829	170112	268717	764359 51
10 645013	438484	169522	268963	764171 50
11 645235	438140	168931	269208	763984 49
12 645458	437795	168341	269454	763796 48
13 645680	437451	167751	269700	763608 47
14 645902	437107	167161	269946	763420 46
15 646124	436764	166571	270192	763232 45
16 646346	436420	165982	270439	763044 44
17 646568	436077	165392	270685	762856 43
18 646790	435734	164802	270932	762668 42
19 647012	435391	164212	271179	762480 41
20 647233	435048	163623	271425	762292 40
21 647455	434706	163033	271673	762104 39
22 647677	434363	162444	271920	761915 38
23 647898	434021	161854	272167	761727 37
24 648120	433679	161265	272415	761538 36
25 648341	433338	160675	272662	761350 35
26 648563	432996	160086	272910	761161 34
27 648784	432655	159497	273158	760972 33
28 649005	432314	158908	273406	760784 32
29 649227	431973	158319	273654	760595 31
30 649448	431632	157730	273903	760406 30

Min.

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Deg. 40 + -

m.	Sines	Logarith.	Differen	Logarit.	Sines	
30	549448	431632	157730	273903	760406	30
31	549669	431292	157141	274151	760217	29
32	549890	430952	156552	274400	760028	28
33	550111	430612	155963	274649	759839	27
34	550332	430272	155374	274898	759650	26
35	550553	429932	154785	275147	759461	25
36	550774	429592	154196	275396	759271	24
37	550995	429253	153608	275645	759082	23
38	551216	428914	153019	275895	758892	22
39	551436	428575	152430	276145	758703	21
40	551657	428236	151842	276394	758514	20
41	551878	427898	151253	276644	758324	19
42	552098	427560	150665	276895	758134	18
43	552319	427222	150077	277145	757945	17
44	552539	426884	149488	277395	757755	16
45	552760	426546	148900	277646	757565	15
46	552980	426208	148312	277897	757375	14
47	553200	425871	147724	278147	757185	13
48	553421	425534	147136	278398	756995	12
49	553641	425197	146548	278650	756805	11
50	553861	424860	145960	278901	756615	10
51	554081	424524	145372	279152	756425	9
52	554301	424188	144784	279404	756234	8
53	554521	423852	144196	279656	756044	7
54	554741	423516	143608	279907	755853	6
55	554961	423180	143020	280159	755663	5
56	555180	422844	142433	280412	755472	4
57	555400	422509	141845	280664	755282	3
58	555620	422174	141257	280917	755091	2
59	555839	421839	140670	281169	754900	1
60	556059	421504	140082	281422	754710	0

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in. Sines	Logarit.	Differē.	Logarit.	Sines	
0 656059	421504	140082	281422	754710	50
1 656278	421170	139495	281675	754519	59
2 656498	420835	138907	281928	754328	58
3 656717	420501	138320	282181	754137	57
4 656937	420167	137732	282435	753946	56
5 657156	419833	137145	282688	753755	55
6 657375	419500	136558	282942	753563	54
7 657594	419167	135971	283196	753372	53
8 657814	418833	135384	283450	753181	52
9 658033	418501	134797	283704	752989	51
10 658252	418168	134210	283958	752798	50
11 658470	417835	133623	284213	752606	49
12 658689	417503	133036	284467	752415	48
13 658908	417171	132449	284722	752223	47
14 659127	416839	131862	284977	752032	46
15 659346	416507	131275	285232	751840	45
16 659564	416175	130688	285487	751648	44
17 659783	415844	130102	285742	751456	43
18 660002	415513	129515	285998	751264	42
19 660220	415182	128928	286253	751072	41
20 660439	414851	128342	286509	750880	40
21 660657	414520	127755	286765	750688	39
22 660875	414190	127169	287021	750496	38
23 661094	413860	126582	287277	750303	37
24 661312	413530	125996	287534	750111	36
25 661530	413200	125410	287790	749919	35
26 661748	412870	124823	288047	749726	34
27 661966	412541	124237	288304	749534	33
28 662184	412211	123651	288561	749341	32
29 662402	411882	123064	288818	749148	31
30 662620	411553	122478	289075	748956	30

Min.

Deg. 48

Deg. 41 +1-

m.	Sines	Logarit	Differē.	Logarit.	Sines.
30	662620	411553	122478	289075	748956
31	662838	411225	121898	289333	748763
32	663056	410896	121306	289590	748570
33	663273	410568	120720	289848	748377
34	663491	410240	120134	290106	748184
35	663709	409912	119548	290364	747991
36	663926	409584	118962	290622	747798
37	664144	409257	118376	290880	747605
38	664361	408929	117790	291139	747412
39	664579	408602	117284	291398	747218
40	664796	408275	116619	291656	747025
41	665013	407948	116033	291915	746832
42	665230	407622	115447	292174	746638
43	665448	407295	114861	292434	746445
44	665665	406969	114276	292693	746251
45	665882	406643	113690	292953	746057
46	666098	406317	113105	293212	745864
47	666316	405992	112519	293472	745670
48	666532	405666	111934	293732	745476
49	666749	405341	111349	293992	745282
50	666966	405016	110763	294253	745088
51	667183	404691	110178	294513	744894
52	667399	404366	109593	294774	744700
53	667616	404042	109007	295034	744506
54	667833	403717	108422	295295	744312
55	668049	403393	107837	295556	744117
56	668265	403069	107252	295818	743923
57	668482	402746	106667	296079	743728
58	668698	402422	106082	296341	743534
59	668914	402099	105497	296602	743339
60	669131	401776	104912	296864	743145

Min

Deg. 42

+1-

m.	Sines	Logarith.	Differen.	Logarit	Sines
0	669131	401776	104912	296864	743145 60
1	669374	401453	104327	297126	742950 59
2	669563	401130	103742	297388	742755 58
3	669779	400807	103157	297651	742560 57
4	669995	400485	102572	297913	742366 56
5	670211	400163	101987	298176	742171 55
6	670427	399841	101402	298438	741976 54
7	670642	399519	100818	298701	741781 43
8	670858	399197	100233	298964	741586 52
9	671074	398876	99648	199228	741390 51
10	671289	398555	99064	299491	741195 50
11	671505	398233	98479	299754	741000 49
12	671721	397913	97894	300018	740805 48
13	671936	397592	97310	300282	740609 47
14	672151	397271	96725	300546	740414 46
15	672367	396951	96141	300810	740218 45
16	672582	396631	95556	301074	740022 44
17	672797	396311	94972	301339	739827 43
18	673012	395991	94388	301604	739631 42
19	673228	395672	93803	301868	739435 41
20	673443	395352	93219	302133	739239 40
21	673658	395033	92635	302398	739043 39
22	673873	394714	92050	302664	738847 38
23	674087	394395	91466	302929	738651 37
24	674302	394076	90882	303194	738455 36
25	674517	393758	90298	303460	738259 35
26	674732	393440	89713	303726	738063 34
27	674946	393121	89129	303992	737867 33
28	675161	392804	88545	304258	737670 32
29	675376	392486	87961	304525	737474 31
30	675590	392168	87377	504791	737277 30

Min.

Deg. 47

Deg. 42 +

m.	Sines.	Logarith.	Differen.	Logarit.	Sines.
30	675590	392168	87377	304791	737277
31	675805	391851	86793	305058	737081
32	676019	391534	86209	305324	736884
33	676233	391217	85625	305591	736687
34	676448	390900	85042	305858	736491
35	676662	390583	84458	306126	736294
36	676876	390267	83874	306393	736097
37	677090	389951	83290	306661	735900
38	677304	389635	82706	306928	735703
39	677518	389319	82122	307196	735506
40	677732	389003	81539	307464	735309
41	677946	388688	80955	307733	735112
42	678160	388372	80371	308001	734914
43	678373	388057	79788	308269	734717
44	678597	387742	79204	308538	734520
45	678801	387427	78620	308807	734322
46	679014	387113	78037	309076	734125
47	679228	386798	77453	309345	733927
48	679441	386484	76870	309614	733730
49	679654	386170	76286	309884	733532
50	679868	385856	75703	310153	733334
51	680081	385543	75120	310423	733137
52	680295	385229	74536	310693	732939
53	680508	384916	73953	310963	732741
54	680721	384603	73370	311233	732543
55	680934	384290	72786	311503	732345
56	681147	383977	72203	311774	732147
57	681360	383664	71620	312045	731949
58	681573	383352	71036	312316	731750
59	681786	383040	70453	312587	731552
60	681998	382728	69870	312858	731354

MLA

Deg. 43 +1-

mil Sines.	Logarit.	Diff. re	Logarit.	Sines
0 681998	382728	69870	312858	73135460
1 682211	382416	69287	313129	73115559
2 682424	382104	68703	313401	73095758
3 682636	381793	68120	313673	73075857
4 682849	381482	67537	313944	73056056
5 683061	381170	66954	314216	73036155
6 683274	380860	66371	314488	73016254
7 683486	380549	65788	314761	72996353
8 683698	380238	65205	315033	72976552
9 683911	379928	64622	315306	72956651
10 684123	379618	64039	315578	72936750
11 684335	379307	63456	315851	72916849
12 684547	378998	62873	316124	72896948
13 684759	378688	62290	316398	72876947
14 684971	378378	61707	316671	72857046
15 685183	378069	61125	316944	72837145
16 685395	377760	60542	317218	72817244
17 685607	377451	59959	317492	72797243
18 685818	377142	59376	317766	72777342
19 686030	376834	58793	318040	72757341
20 686242	376525	58210	318315	72737440
21 686453	376217	57628	318589	72717439
22 686665	375909	57045	318864	72697438
23 686876	375601	56462	319139	72677537
24 687088	375293	55879	319414	72657536
25 687299	374986	55297	319689	72637535
26 687510	374679	54714	319964	72617534
27 687721	374371	54131	320240	72597533
28 687932	374064	53549	320515	72577532
29 688144	373758	52966	320791	72557531
30 688355	373451	52384	321067	72537430

Min.

Deg. 46

Deg. 43 + | -

	Sines	Logarit.	Differē.	Logarit.	Sines	
5460	30 688355	373451	52384	321067	725374	30
5559	31 588566	373145	51801	321343	725174	29
5758	32 688776	372838	51219	321620	724974	28
5857	33 688987	372532	50636	321896	724773	27
6056	34 689198	372226	50054	322173	724573	26
6155	35 689409	371921	49471	322449	724372	25
6254	36 689620	371615	48889	322726	724172	24
6353	37 689830	371310	48306	323003	723971	23
6552	38 690041	371004	47724	323281	723770	22
6651	39 690251	370700	47141	323558	723570	21
6750	40 690462	370395	46559	323836	723369	20
6849	41 690672	370090	45976	324114	723168	19
6948	42 690882	369785	45394	324392	722967	18
7047	43 691093	369481	44811	324670	722766	17
7146	44 691303	369177	44229	324948	722565	16
7245	45 691513	368873	43647	325226	722364	15
7344	46 691723	368569	43064	325505	722163	14
7443	47 691933	368266	42482	325783	721961	13
7542	48 692143	367962	41900	326062	721760	12
7641	49 692353	367659	41318	326341	721559	11
7740	50 692563	367356	40735	326620	721357	10
7839	51 692773	367053	40153	326900	721156	9
7938	52 692982	366750	39571	327179	720954	8
8037	53 693192	366448	38989	327459	720753	7
8136	54 693402	366145	38407	327739	720551	6
8235	55 693611	365843	37824	328019	720349	5
8334	56 693821	365541	37242	328299	720148	4
8433	57 694030	365239	36660	328579	719946	3
8532	58 694240	364938	36078	328860	719744	2
8631	59 694449	364636	35496	329140	719542	1
8730	60 694658	364335	34914	329421	719340	0

Min.

Deg. 46

Deg. 44 + -

m.	Sines.	Logarit.	Differ.	Logarit.	Sines.	m.
0	694658	364335	34914	329421	719340	60
1	694868	364034	34331	329702	719138	59
2	695077	363733	33749	329983	718935	58
3	695286	363432	33167	330265	718733	57
4	695495	363131	32585	330546	718531	56
5	695704	362831	32003	330828	718329	55
6	695913	362531	31421	331110	718126	54
7	696122	362231	30839	331392	717924	53
8	696330	361931	30257	331674	717721	52
9	696539	361631	29675	331956	717519	51
10	696748	361331	29093	332238	717316	50
11	696959	361032	28511	332521	717113	49
12	697165	360733	27929	332804	716911	48
13	697374	360434	27347	333087	716708	47
14	697582	360135	26765	333370	716505	46
15	697790	359836	26183	333653	716302	45
16	697999	359538	25601	333937	716099	44
17	698207	359239	25019	334220	715896	43
18	698415	358941	24437	334504	715693	42
19	698623	358643	23855	334788	715489	41
20	698832	358345	23273	335072	715286	40
21	699040	358048	22691	335357	715083	39
22	699248	357750	22109	335641	714880	38
23	699455	357453	21527	335926	714676	37
24	699663	357156	20945	336210	714473	36
25	699871	356859	20363	336495	714269	35
26	700079	356562	19782	336781	714065	34
27	700287	356266	19200	337066	713862	33
28	700494	355969	18618	337351	713658	32
29	700702	355673	18036	337637	713454	31
30	700909	355377	17454	337923	713250	30

Mis.

Deg. 45

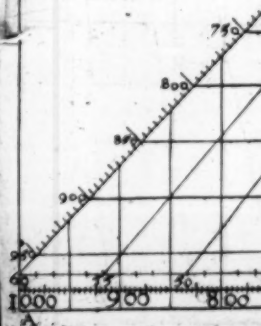
Deg. 44 +1-

m. Sines	Logarit.	Differē.	Logarit.	Sines.	
60	30700909	355377	17454	337923	713250 30
59	31701117	355081	16872	338208	713046 29
58	32701324	354785	16290	338495	712842 28
57	33701531	354489	15709	338781	712638 27
56	34701739	354194	15127	339067	712434 26
55	35701946	353899	14545	339354	712230 25
54	36702153	353604	13963	339641	712026 24
53	37702360	353309	13381	339927	711822 23
52	38702567	353014	12800	440215	711617 22
51	39702774	352720	12218	340502	711413 21
50	40702981	352425	11636	340789	711209 20
49	41703188	352131	11054	341077	711004 19
48	42703395	351837	10472	341365	710799 18
47	43703601	351543	9890	341653	710595 17
46	44703808	351249	9309	341941	710390 16
45	45704015	350956	8727	342229	710185 15
44	46704221	350662	8145	342518	709981 14
43	47704428	350369	7563	342806	709776 13
42	48704634	350076	6982	343094	709571 12
41	49704841	349783	6401	343383	709366 11
40	50705047	349491	5818	343673	709161 10
39	51705253	349198	5236	343962	708956 9
38	52705459	348906	4654	344252	708750 8
37	53705665	348614	4073	344541	708545 7
36	54705872	348322	3491	344831	708340 6
35	55706078	348030	2909	345121	708134 5
34	56706284	347738	2327	345411	707929 4
33	57706489	347447	1745	345701	707724 3
32	58706695	347156	1164	345992	707518 2
31	59706901	346864	582	346283	707312 1
60	707107	346573	0	346573	707107 0

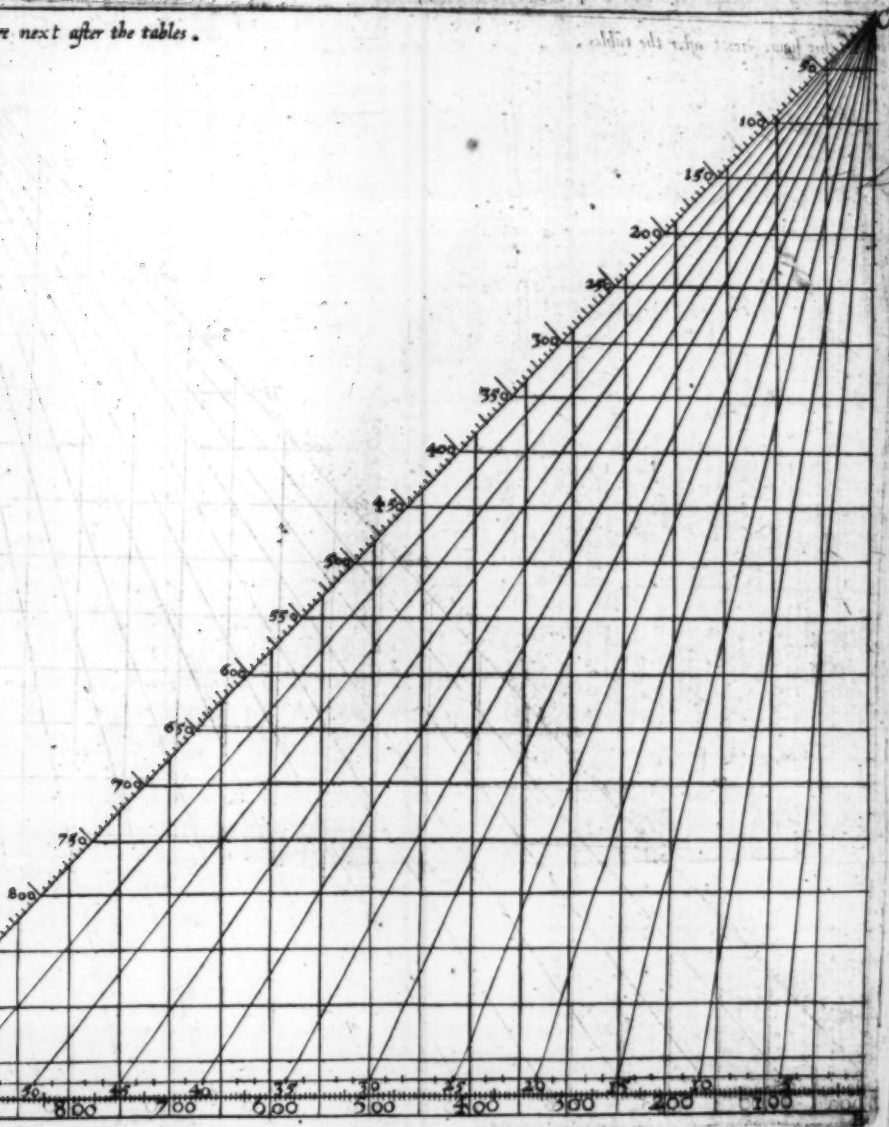
Min.

Deg. 45

Place this figure next after



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Pag. 8
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THE VSE OF THE TRI-
angular Table for the finding of
the part Proportionall, penned
by Henry Briggs.

THE compendiousnesse of
these Tables of *Logarithmes*,
cannot be without some de-
fect, which is to be supplied
(as in all other Tables) by
the part proportionall: that
whereas sometimes the num-
ber we desire, is not to be found in the Table,
we may by the difference of that number,
the number in the Table neereſt vnto it, and
the proportionall part answerable to that
difference, haue our desire, ſo neere as may
be, or is needfull. This proportionall part is
had three wayes.

1. Either by the Rule of Proportion, com-
monly called the Golden Rule: Or

2. By the helpe of this Table of *Loga-
rithmes*. Or

3. By this Triangular instrumentall Table.
Of which three wayes the first is moſt exact,
and the laſt moſt eaſie, but not ſo exact as the
other two. All theſe wayes hauing three num-
bers giuen, do helpe vs to finde the fourth pro-
portionall number. The manner of the opera-
tion is beſt ſhewed by example.

Pag. 81. lin. 15. we haue found that 141766 is
the *Logarithme* of halfe the angle P Z S.
which number I ſeek in the Table, and finde
it not; but the two *Logarithmes* next vnto it,
are

are 141834 and 141667, which answer to 12' & 13' minuts about 60 degrees: so that it is apparant, that the arke which we seeke is 60: 12 and more. Now to finde how much more is to be added to this number, I take the difference of the tabular Logarithmes, 167 being first of the three numbers, which before I said must be giuen, and the difference of the two answerable tabular arkes 60 seconds, which is the second giuen number, and these two may fitly be termed *Tabular differences*. The third giuen number which we call the *Occurring difference*, is the difference of the former of the two Tabular Logarithmes, and of this Logarithme 141766 which we seeke for: which difference is 68. These three giuen numbers 167 60. 68 do helpe vs to the part proportionall, to be added to 60: 12, by euery one of the three former wayes.

1. By the golden rule I multiply the third 68, by the second 60, and the product 4080 being diuided by the first 167, giueth in the quotient $24 \frac{1}{2}$ almost, so that the arke answering to halfe the angle P Z S, is found to be 60: 12, $24 \frac{1}{2}$.

2 By this Table of Logarithmes thus, I take the Logarithmes of these three giuen numbers, so neere as the bare Table will affoord, without any further curious search (because in this case I need not seeke to be exact; and for the same cause I cut off the two last figures in euery Logarithme) the Logarithmes I find to be 17928.5109.3943. But because the numbers in the Table, to which the Logarithmes are adioyned, are *Sines*, and I haue found these Logarithmes answerably, as if the giuen numbers were 167. 600. 681, It is therefore apparant

rant, that the fourth proportionall, which I seeke for, must likewise increas above the totall Sine; so that his Logarithme is lesse then nothing, and the number answering to it is not to be found in this Table. Therefore by the 4. chap. 1. lib. the 9 Sect. pag 18. I doe adde 23025 (cutting off here also the two last figures) to the Logarithme of 680: therefore the third number being 68, and not 680. his Logarithme by this new increase is 28134. And because by the 5 prop. 2. chap. lib. x. the Logarithmes of the two middle numbers are equall to the Logarithmes of the two extreame proportionals, therefore out of 32077, the summe of the two middle Logarithmes I take 17928, the Logarithme of the first, and there remaineth 14149. the Logarithme of the fourth proportionall, which I desire: to the which, in the Table, 243 doth answer. Therefore I say, as before, that the proportionall part to bee added to the arke found, is $24\frac{3}{10}$. For though the fourth proportionall 243 be of 3 figures, yet wee may presently discern that the cause of this greatnesse in this last proportionall is because the one of the two middle numbers is too great, which should be onely 60 and 68, and that if here we cut off the last figure, then will the foure numbers keepe due proportion $167.60.68.24\frac{3}{10}$.

3 The third way of finding this proportionall part, is by this triangular table which was drawne by Mr. E. Wright; and because at his death he left no description of it, nor manner how to vse it, at the request of some friends, I make bold to supply his place so well and plainly as I can.

Your

(4)

You see then in this triangle, three sorts of lines, some paralell to the base AB, others perpendicular vnto it, and the third sort drawne all from the verticall angle C, vnto equall partes of the base. These last may be called *Diagonall* lines.

You see likewise the base AB diuided into 60 equall parts, and a line vnder it, and paralell vnto it into 1000.

In like sort, the perpendicular line CB is diuided into 1000, and vpon the intersections of the paralells, and the Diagonall CA are set the same numbers that are set vpon the other ends of the paralels, in the perpendicular CB. Amongst these numbers we must place our three giuen numbers, and by helpe of the lines we shall amongst the same, finde out Geometrically, the fourth proportionall, which we desire.

For Example.

Take the same numbers wee had before 167, and 60. the two Tabular Differences, and 68 the Occurring difference. Of these there are two which are differences of Logarithmes, to wit, 167, and 68, the first and the third: these being of one kinde, or Homogeneall, are to haue like situation in the Triangle. And the second being Homogeneall to the fourth, which is sought for, is to bee placed on a differing side from the other two, vpon which differing side the fourth proportionall is to bee found. As here I take 167, and 68, and count them from the poynt C in the Diagonall line CA, and supposing a perpendicular line to bee drawne from the end of the lesse number till it cut the paralel

rall

(5)

parallel line drawne from the end of the greater number, by this poynt of Interfection I drawe an imaginarie Diagonall line from the poynt C, till it cut the Base AB, and counting from B to that Diagonall, I finde 24, and about $\frac{1}{3}$, which is the part proportionall I desire, as in the former operations.

But because 167 and 68 are such small numbers, and fall so neere the angle, therefore the concurrence of the parallel and perpendicular is not so exactly discerned, and the whole operation is more troublesome and uncertaine. It is therefore conuenient in such cases, to take the double, or treble of both these giuen numbers, or the halfes, or any like parts of them both: and to enter the Table with these other numbers, in stead of the former, proceeding in all things as before; then shall we, when the numbers reach neerer vnto the Base, finde the poynt of concurrence, and the part proportionall more exactly and easily then before. As if we take 835 and 340 the quintuples of the first and third numbers, wee shall more plainly and distinctly finde the fourth proportionall to be $24\frac{1}{3}$.

In like sort, page 52, line 36, I would finde the differentiaall answering to $16^{\circ} : 24' : 27''$. and because the Table extendeth but to minutes, I must finde the part proportionall answering to $27''$. Here the first giuen number is the Tabular difference of minutes $60''$: the third number is the Occurring Homogeneall difference $27''$. The second giuen number is the Tabular difference of the Differentials 1074. These three I place thus: The first $60''$.

K

and:

and the third 27 , being *Homogeneall* vnto it, I place vpon the base AB : and because the second 1074 is too great for the table, & if one figure be cut away 107 remaining wil fall vpon the Diagonall line CA (on the which it is to be placed) too neere to the angle C , therefore I take 537 , the halfe of the second, and place it vpon the Diagonall line CA , drawing a paralell from that poynt, till it meete with the Diagonall comming from 27 , and from the concourse of that paralell with this Diagonal, I draw a perpendicular vpwards, till it cut the Diagonall line of 60 . or the line CA , and I finde that the distance of this intersection from C , is about 240 , which is the halfe of the fourth proportionall, because 537 is the halfe of the second giuen number *Homogeneall* vnto this fourth. I say therefore that the part proportionall answering vnto 27 , is 480 . which being subducted from 1223101 , the differentiaall of $160:24$, there remaineth 1222621 for the differentiaall of $160:24,27$, which differeth somewhat from that differentiaall which is set downe in the booke: the reason whereof is, because in so small a Table it is impossible to discerne all the seuerall parts, the omission of which will make no sensible difference in any worke. If in seeking the square roote, or cubicke roote of 19 , I would finde the Logarithme of 190000 , seeking this number amongst the *Sines*, I cannot finde it, but at $100:57$ I finde 189952 , which is lesse then the giuen number by 48 . This is the *Occurring difference*. The tabular difference *Homogeneall* to this, is 286 . The other tabular difference of the Logarithmes is 1502 : these differences are giuen, which being placed in due order, the first of them

(7)

them is 286. the second 1502, the third 48, and that the first & third number may fall neerer to the base, I double them both, so haue I 572, and 96, these I place, in stead of the other giuen numbers, vpon the perpendicular C B, or on the Diagonall C A. Likewise because the second number 1502 is too great, I take the the halfe of it, so haue I 751, which I place vnder the base A B, vpon the line diuided into 1000: and from that point draw a diagonall, till it meete with the paralell of 96. the third number, and from the poynt of concourse with that paralell, I draw a perpendicular, till it crosse the paralell of 571 the first number. By this last concourse of the perpendicular and paralell, I draw an other diagonall, cutting the line vnder A B, in which the second number was counted, and the parts 125 betwixt that poynt and the end of the line towards B, being doubled, (because the second being Homogeneall to this, was halfed) are the fourth proportionall required, which may bee 250. and this proportionall being taken away from the tabular Logarithme 1660982, leaueth 1660732 for the Logarithme of 190000.

The same may be performed, if the first and third be placed on the base; and the second vpon the side line, thus; Draw two Diagonals from those two points of the base, & from the concourse of the Diagonall of the third with the paralell of the second, draw a perpendicular vpward, till it meete with the Diagonall of the first; the paralell passing by that point, shall in the line C B shew the fourth proportionall.

Thus may wee instrumentally come somewhat neerer to that which wee desire, especially

(8)

cially if vpon a faire large Pafte-board
wee make a great Triangle, curi-
oufly diuided and lined, ac-
cording to this pat-
terne.

FINIS.

Errata in the Treatise.

- Pag. 15. lin. 28. make it Tangéts 1370505
lin. 29. Make it number 1370305
Pag. 19. lin. 25. reade 4605168—00
Pag. 21. lin. 33. reade —34914—00
Pag. 29. lin. 10. reade —693147
Pag. 45. lin. 4. reade Z S P.
Pag. 72. lin. 30. reade Z P.
Pag. 75 lin. 17. reade half the aggregate.

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47

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K 2

Die Grunnschicht betropf Clupe

Queen's College Library
DESCRIPTION
OF THE ADMIRABLE
TABLE OF LOGA-
RITHMES:

for WITH *Figures*
A DECLARATION OF
THE MOST PLENTIFUL, EASY,
and speedy vse thereof in both kinds
of Trigonometrie, as also in all
Mathematicall calculations.

INVENTED AND PVBLI-
SHED IN LATIN BY THAT
Honorable L. JOHN NEPARE, Ba-
ron of Marchiston, and translated into
English by the late learned and
famous Mathematician
Edward Wright. D. 18. 75.

*With an Addition of an Instrumentall Table
to finde the parts proportionall, inserted by
the Translator, and described in the end
of the booke by HENRY BEINE
Geometry-reader at Gresham
house in London.*

All perused and approved by the Author, & pub-
lished since the death of the Translator.

LONDON,
Printed by NICHOLAS OKEN
1616.



1700



TO THE RIGHT
HONOURABLE AND
RIGHT WORSHIPFULL
COMPANY OF MERCHANTS
of London trading to the East-

Indies, SAMVEL WRIGHT

*wisheth all prosperitie in this
life, and happinesse in the
life to come.*



Our fauours towards
my deceased Father,
and your imployment
of him in businesse of
this nature, but chiefe-
ly your continuall im-
ployment of so many Mariners in so
many goodly and costly ships, in long
and dangerous vbyages, for whose vse
(though many other wayes profitable)
this little booke is chiefly behoouefull:
may chalenge an interest in these his
labours. This *Book* is noble by birth, as
being descended from a Noble Parent,
& not ignoble by educatiō, hauing lear-
ned to speake English of my late Fa-

ther, a man in the iudgment of the learned, and experience of the common sort, famous for knowledge and practise in the Mathematickes : whose care thereof was so great, to send it abroad with the true resemblance of his worthy father, and sufficient knowledge of the English tongue to instruct our Countrey-men, that hee procured the Authors perusall of it: who after great paines taken therein, gaue approbation to it, both in substance and forme, as now I present it vnto you. I am the bolder thus to do, in regard it is not vnknowne to many men, that my said father spent a great part of his time in study of the Art of Nauigation, and had gathered much vnderstanding by his owne practise in some voyages to sea with the right Honourable the Earle of *Cumberland* deceased: whereupon he published a painful worke discovering errours committed by Mariners in that Art, with corrections and ready wayes for reformation therof. So that I thinke it is out of doubt, that his iudgement therein was great. And seeing hee not onely gaue much commendation of this worke (and often in my hearing) as of very great vse for Mariners :

ners:but also to help the want of those
that could not vnderstand it in Latine,
translated the same into English, and
added thereto an instrumentall Table
to finde the part proportional,whereof
also the noble Author approued well. I
doubt not but it is apparant enough
that he esteemed of it, and intended to
haue recommended it as a booke of
more then ordinary worth,especially to
Sea-men. But shortly after he had it re-
turned out of *Scotland*,it pleased God
to call him away afore he could pub-
lish it, or but write a description of the
said instrumentall Table which he had
deuised, therefore hee left the publish-
ing of it to me, as an inheritance, and
the said description to his learned and
kind friend Mr. *Henry Triggers*, who
hath performed it accordingly. All
which I humbly present vnto you, ho-
ping you shall receaue as much profite
by the vse of it, as there hath been lear-
ning, care, and paines bestowed in the
penning and setting it thus to your
hands.

same in this short Treatise.

From whence it followeth, that the three angles of a Sphericall triangle being giuen, the sides are found by an easie conuersion.

As in the former triangle QRT , let the angles be giuen Q 47, R 111, and T 34, let the sides be sought.

For any one angle, for example sake, (as before) for R 111, let the remainder thereof to a semicircle 69 degrees be taken.

Then 47, 69, 34 being set for sides (as was done in the former triangle PZS , by any of the three wayes aboue written, seeke his angles, and you shall finde,

Against the side 47, the angle 42.29.59.

And against the side 34 the angle 31. 6. 5.

And against the side 69 (which wee put for 111) you shall finde the angle 120.24. 49. Therefore in the triangle propounded, QRT .

For the side RT subtending the angle Q 47, set downe 42 29, 59.

And for the side QR subtending the angle T 34, set downe 31. 6. 5.

But for the side QT subtending the angle R 111. set downe 59, 35, 11.

Which are the remainder of 120 deg. 24, 49. to a semicircle, because before you tooke for 111 his remainder to a semicircle, that is 69. And so by conuersion you shal finde the sides by the angles.

An Admonition.

OVt of this finding of the sides by the angles giuen, three diuers questions of this and any other triangle whatsoeuer are resolved.

As in the triangle PZS out of the houre of the day, the azimuth of the Sunne, and the angle of

CHAP. 6. *The second Booke.* 89

of the site or position of the Sunne, this proposition going before, giueth satisfaction to the question, whereby either

- 1 The height of the pole,
- 2 The height of the Sunne, or
- 3 The declination of the Sunne is demanded.

Therefore (out of the 8 sect. of the former 5 chap. and the 7 & 12 sect. of this booke) you haue the solution of 60 seuerall questions, wch fall into any triangle: neither can there any moe varieties then these arise out of the manifold composition of any three parts.

You haue therefore a perfect & absolute doctrine of triangles, as well Sphericall as Plaine.

THE CONCLUSION.

Now therefore it hath been sufficiently shewed that there are Logarithmes, what they are, and of what use they are: for with helpe of them we haue both demonstratiuely shewed and taught by examples of both kindes of Trigonometrie, that the Arithmeticall solution of any Geometricall question may most readily bee performed without trouble of Multiplication, Diuision, or extraction of roots. You haue therefore the admirable Table of Logarithmes that was promised, together with the most plentifull use thereof, which if (to you of the learned sort) I shall by your letters understand to be acceptable to you, I shall be incouraged to set forth also the way to make the Table. In the meane time, make use of this short Treatise, and giue all praise and glory to God the high Inuenter and guider of all good workes.

The end of the Treatise.

Now followeth the Table or Canon of
Logarithmes.

88 22008 8000 1000 22.9410

Deg. 0

+1-

mi	Sines	Logarith.	Differen.	Logarith.	Sines
0	0	Infinite.	Infinite.	.0	1000000.060
1	291	8142567	8142568	.1	1000000.059
2	582	7449419	7449421	.2	999999.858
3	873	7043952	7043956	.4	999999.657
4	1164	6756275	6756274	.7	999999.356
5	1454	6533131	6533130	1.1	999998.955
6	1745	6350810	6350808	1.6	999998.654
7	2036	6196659	6196657	2.2	999998.053
8	2327	6063128	6063126	2.8	999997.452
9	2618	5945345	5945342	3.5	999996.751
10	2909	5839986	5839984	4.3	999995.950
11	3200	5744676	5744671	5.2	999995.049
12	3491	5657665	5657658	6.2	999994.048
13	3781	5577622	5577615	7.3	999992.847
14	4072	5503514	5503506	8.4	999991.746
15	4363	5434522	5434513	9.6	999990.545
16	4654	5369984	5369973	10.9	999989.244
17	4945	5309360	5309348	12.3	999987.843
18	5236	5252202	5252188	13.8	999986.342
19	5527	5198136	5198120	15.4	999984.741
20	5818	5146843	5146836	17.0	999983.140
21	6109	5098054	5098045	18.7	999981.339
22	6399	5051534	5051514	20.5	999979.538
23	6690	5007083	5007060	22.4	999977.637
24	6981	4964524	4964499	24.4	999975.636
25	7272	4923703	4923676	26.5	999973.635
26	7563	4884483	4884454	28.7	999971.434
27	7854	4846743	4846712	30.9	999969.233
28	8145	4810376	4810343	33.2	999966.832
29	8436	4775286	4775250	35.6	999964.431
30	8726	4741385	4741347	38.1	999961.930

Mitt.

Deg. 89

Deg. 0

+/-

mi	Sines	Logarith.	Differen.	Logarith.	Sines
30	8726	4741385	4741347	38.1	999961.9
31	9017	4708596	4708555	40.7	999959.3
32	9308	4676848	4676805	43.4	999956.6
33	9599	4646077	4646031	46.1	999953.9
34	9890	4616225	4616176	48.9	999951.1
35	10181	4587239	4587187	51.8	999948.2
36	10472	4559069	4559014	54.8	999945.2
37	10763	4531671	4531613	57.9	999942.1
38	11054	4505004	4504943	61.1	999938.9
39	11344	4479030	4478965	64.4	999935.7
40	11635	4453713	4453645	67.7	999932.3
41	11926	4429022	4428950	71.1	999928.9
42	12217	4404925	4404850	74.6	999925.4
43	12508	4381396	4381318	78.2	999921.8
44	12799	4358408	4358326	81.9	999918.1
45	13090	4335936	4335850	85.7	999914.3
46	13380	4313958	4313868	89.6	999910.5
47	13671	4292453	4292360	93.5	999906.5
48	13962	4271401	4271304	97.5	999902.5
49	14253	4250783	4250682	101.6	999898.4
50	14544	4230583	4230477	105.8	999894.2
51	14835	4210781	4210671	110.1	999890.0
52	15126	4191364	4191250	114.5	999885.6
53	15416	4172317	4172198	118.9	999881.1
54	15707	4153627	4153504	123.4	999876.6
55	15998	4135279	4135151	128.0	999872.0
56	16289	4117263	4117130	132.7	999867.3
57	16580	4100664	4100527	137.5	999862.5
58	16871	4082175	4082032	142.4	999857.7
59	17162	4065082	4064935	147.3	999852.7
60	17453	4048276	4048124	152.3	999847.7

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Deg. 89

Min.

Deg. 1 + | -

m.	Sines.	Logarith.	Differen.	Logarit.	Sines.
0	17452	4048276	4048124	152	99984860
1	17743	4031748	4031591	157	99984359
2	18034	4015490	4015327	162	99983758
3	18325	3999492	3999324	168	99983257
4	18615	398374	3983571	173	99982756
5	18907	396824	3968063	179	99982155
6	19197	3952976	3952792	184	99981654
7	19488	3937941	3937751	190	99981053
8	19779	3923127	3922932	196	99980452
9	20070	3908531	3908329	201	99979951
10	20361	2894144	3893937	207	99979350
11	20652	3879961	3879748	213	99978749
12	20942	3865977	3865757	219	99978148
13	21233	3852186	3851960	225	99977547
14	21524	3838582	3838351	232	99976946
15	21815	3825161	3824923	238	99976345
16	22106	3811918	3811674	244	99975744
17	22396	3798848	3798597	251	99975143
18	22687	3785947	3785690	257	99974542
19	22978	3773210	3772946	264	99973941
20	23269	3760634	3760363	271	99973340
21	23560	3748213	3747936	278	99972739
22	23850	3735946	3735661	284	99972138
23	24141	3723827	3723535	291	99971537
24	24432	3711853	3711555	299	99970936
25	24723	3700021	3699715	306	99970335
26	25014	3688327	3688014	313	99969734
27	25304	3676769	3676449	320	99969133
28	25595	3665343	3665015	328	99968532
29	25886	3654045	3653710	335	99967931
30	26177	3642875	3642532	343	99967330

Min.

Deg. 88

Deg. I +|-

m	Sines	Logarith	Differen	Logarit.	Sines.
60	30 26177	3642875	3642532	343	999657 30
59	31 26468	3631827	3631477	350	999650 29
58	32 26758	3620901	3620542	368	999642 28
57	33 27049	3610092	3609726	366	999634 27
56	34 27340	3599400	3599026	374	999626 26
55	35 27631	3588821	3588439	382	999618 25
54	36 27922	3578352	3577962	390	999610 24
53	37 28212	3567992	3567593	398	999602 23
52	38 28502	3557737	3557331	406	999594 22
51	39 28794	3547589	3547174	415	999585 21
50	40 29085	3537541	3537118	423	999577 20
49	41 29375	3527593	3527162	431	999568 19
48	42 29666	3517744	3517304	440	999560 18
47	43 29957	3507991	3507542	449	999551 17
46	44 30248	3498332	3497874	458	999542 16
45	45 30538	3488765	3488299	466	999534 15
44	46 30829	3479289	3478814	475	999525 14
43	47 31120	3469903	3469418	484	999516 13
42	48 31411	3460604	3460110	493	999507 12
41	49 31701	3451390	3450887	503	999497 11
40	50 31992	3442261	3441749	512	999488 10
39	51 32283	3433214	3432693	521	999479 9
38	52 32574	3424248	3423718	530	999469 8
37	53 32864	3415363	3414823	540	999460 7
36	54 33155	3407655	3407105	550	999450 6
35	55 33446	3399782	3399265	560	999440 5
34	56 33737	3389170	3388601	569	999431 4
33	57 34027	3380589	3380010	579	999421 3
32	58 34318	3372082	3371493	589	999411 2
31	59 34609	3363646	3363047	599	999401 1
30	60 34899	3354528	3354672	609	999391 0

Min.

Deg. 88

Deg. 2 +1- 1 200

m.	Sines.	Logarith.	Differen.	Logarit.	Sines.
0	34899	3355282	3354672	609	99939160
1	35190	3346989	3346366	620	99938159
2	35481	3338759	3338129	630	99937058
3	35772	3330599	3329959	640	99936057
4	36062	3322506	3321855	650	99934956
5	36353	3314477	3313816	661	99933955
6	36644	3306513	3305841	672	99932854
7	36934	3298611	3297928	682	99931853
8	37225	3290771	3290078	693	99930752
9	37516	3282992	3282288	704	99929651
10	37806	3275274	3274559	715	99928550
11	38097	3267615	3266889	726	99927049
12	38388	3260014	3259287	737	99926348
13	38678	3252471	3251722	748	99925247
14	38969	3244984	3244224	760	99924046
15	39260	3237553	3236781	771	99922955
16	39550	3230176	3229393	783	99921744
17	39841	3222854	3222060	794	99920643
18	40132	3215585	3214779	806	99919542
19	40422	3208369	3207552	818	99918341
20	40713	3201204	3200375	830	99917140
21	41004	3194091	3193249	841	99915939
22	41294	3187028	3186174	853	99914738
23	41585	3180014	3179149	865	99913537
24	41876	3173049	3172172	878	99912336
25	42166	3166133	3165243	890	99911035
26	42457	3159264	3158362	902	99909834
27	42748	3152442	3151532	914	99908633
28	43038	3145667	3144740	927	99907332
29	43329	3138937	3137997	940	99906131
30	43619	3132252	3131300	952	99904830

Min.

38 200

Deg. 87

Deg. 2 +1-

	Sines	Logarith.	Differen.	Logarit.	Sines
0	43619	3132252	3131300	952	99904830
1	43910	3125612	3124647	965	99903529
2	44201	3119016	3118038	978	99902318
3	44491	3112463	3111472	991	99901017
4	44782	3105952	3104948	1004	99899726
5	45072	3099484	3098467	1017	99898425
6	45363	3093058	3092028	1030	99897124
7	45654	3086672	3085629	1043	99895823
8	45944	3080328	3079271	1056	99894522
9	46235	3074023	3072953	1070	99893221
10	46525	3067758	3066674	1083	99891920
11	46816	3061532	3060435	1097	99890619
12	47106	3055344	3054233	1111	99889318
13	47397	3049195	3048070	1124	99888017
14	47688	3043083	3041945	1138	99886716
15	47978	3037009	3035857	1152	99885415
16	48269	3030971	3029805	1166	99884114
17	48559	3024970	3023790	1180	99882813
18	48850	3019005	3017810	1194	99881512
19	49140	3013075	3011866	1209	99880211
20	49431	3007180	3005950	1223	99878910
21	49721	3001319	3000082	1238	99877609
22	50012	2995493	2994241	1252	99876308
23	50302	2989701	2988435	1267	99875007
24	50593	2983942	2982661	1281	99873706
25	50883	2978216	2976920	1296	99872405
26	51174	2972524	2971212	1311	99871104
27	51464	2966863	2965537	1326	99869803
28	51755	2961233	2959892	1341	99868502
29	52045	2955636	2954280	1356	99867201
30	52336	2950071	2948699	1372	99865900

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Min.

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Deg. 87

Deg. 3

11

m.	Sines	Logarith.	Differen.	Logarit.	Sines	m.
0	52336	2950071	2948699	1371	99862960	30
1	52626	2944535	2943149	1387	99861459	31
2	52917	2939030	2937629	1402	99859958	32
3	53207	2933556	2932139	1418	99858357	33
4	53498	2928112	2926671	1433	99856856	34
5	53788	2922697	2921249	1449	99855255	35
6	54079	2917311	2915847	1464	99853754	36
7	54369	2911954	2910475	1480	99852153	37
8	54660	2906627	2905131	1496	99850552	38
9	54950	2901327	2899815	1512	99848951	39
10	55241	2896056	2894528	1528	99847350	40
11	55531	2890812	2889267	1544	99845749	41
12	55822	2885595	2884035	1560	99844148	42
13	56112	2880406	2878829	1577	99842447	43
14	56402	2875243	2873650	1593	99840849	44
15	56693	2870107	2868497	1610	99839245	45
16	56983	2864997	2863371	1626	99837544	46
17	57274	2859914	2858271	1643	99835943	47
18	57564	2854857	2853198	1659	99834242	48
19	57854	2849825	2848148	1676	99832541	49
20	58145	2844818	2843125	1693	99830840	50
21	58435	2839835	2838125	1710	99829139	51
22	58726	2834878	2833151	1727	99827438	52
23	59016	2829946	2828201	1744	99825737	53
24	59306	2825038	2823276	1762	99824036	54
25	59597	2820153	2818375	1779	99822335	55
26	59887	2815293	2813497	1796	99820534	56
27	60177	2810456	2808642	1814	99818833	57
28	60468	2805643	2803811	1831	99817032	58
29	60758	2800852	2799003	1849	99815231	59
30	61048	2796085	2794218	1867	99813530	60

Min.

78

Deg. 86

Deg. 3 $\frac{+}{-}$

m.	Sines.	Logarith	Differen.	Logarith	Sines.
0	30	61048	2796085	1867	99813530
1	31	61339	2791340	1885	99811729
2	32	61629	2786618	1903	99809928
3	33	61920	2781918	1921	99808127
4	34	62210	2777241	1939	99806326
5	35	62500	2772585	1957	99804525
6	36	62790	2767950	1975	99802724
7	37	63081	2763337	1993	99800923
8	38	63371	2758746	2012	99799122
9	39	63661	2754175	2030	99797321
10	40	63952	2749626	2049	99795520
11	41	64242	2745097	2068	99793719
12	42	64532	2740588	2086	99791918
13	43	64823	2736100	2105	99790117
14	44	65113	2731632	2124	99788316
15	45	65403	2727184	2143	99786515
16	46	65693	2722756	2162	99784714
17	47	65984	2718348	2181	99782913
18	48	66274	2713958	2201	99781112
19	49	66564	2709588	2220	99779311
20	50	66854	2705237	2240	99777510
21	51	67145	2700906	2259	99775709
22	52	67435	2696592	2279	99773908
23	53	67725	2692298	2298	99772107
24	54	68015	2688022	2318	99770306
25	55	68305	2683764	2338	99768505
26	56	68596	2679524	2358	99766704
27	57	68886	2675303	2378	99764903
28	58	69176	2671098	2398	99763102
29	59	69466	2666913	2419	99761301
30	60	69756	2662744	2439	99759500

Min

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m.	Sines	Logarith.	Differen.	Logarit.	Sines	m.
0	69756	2662744	2660305	2439	99756460	30
1	70047	2658593	2656133	2459	99754459	31
2	70337	2654459	2651979	2480	99752358	32
3	70627	2650342	2647841	2500	99750357	33
4	70917	2646242	2643721	2521	99748256	34
5	71207	2642159	2639617	2542	99746155	35
6	71497	2638093	2635530	2563	99744154	36
7	71788	2634043	2631459	2583	99742053	37
8	72078	2630009	2627405	2604	99739952	38
9	72368	2625992	2623367	2625	99737851	39
10	72658	2621991	2619345	2646	99735750	40
11	72948	2618007	2615339	2668	99733649	41
12	73238	2614038	2611349	2689	99731548	42
13	73528	2610084	2607373	2710	99729447	43
14	73818	2606146	2603415	2732	99727346	44
15	74108	2602224	2599471	2753	99725245	45
16	74398	2598318	2595542	2775	99723144	46
17	74689	2594426	2591629	2797	99721043	47
18	74979	2590550	2587731	2819	99718942	48
19	75269	2586688	2583848	2841	99716841	49
20	75559	2582842	2579980	2863	99714740	50
21	75849	2579011	2575126	2885	99712639	51
22	76139	2575194	2571287	2907	99710538	52
23	76429	2571392	2567473	2929	99708437	53
24	76718	2567604	2563653	2952	99706336	54
25	77009	2563831	2560857	2974	99704235	55
26	77299	2560072	2557076	2996	99702134	56
27	77589	2556327	2553308	3019	99699933	57
28	77879	2552597	2549555	3042	99697832	58
29	78169	2548880	2545815	3065	99695731	59
30	78459	2545177	2542089	3087	99693629	60

Min.

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m.	Sines	Logarith.	Differen.	Logarit.	Sines	
30	78459	2545177	2542089	3087	996917	30
31	78749	2541488	2538377	3110	996894	29
32	79039	2537812	2534678	3133	996871	28
33	79329	2534150	2530993	3156	996848	27
34	79619	2530501	2527322	3180	996825	26
35	79909	2526866	2523663	3203	996802	25
36	80199	2523244	2520018	3226	996779	24
37	80489	2519635	2516386	3250	996755	23
38	80779	2516040	2512767	3273	996732	22
39	81069	2512457	2509160	3297	996708	21
40	81359	2508887	2505566	3321	996685	20
41	81649	2505330	2501985	3344	996661	19
42	81938	2501785	2498417	3368	996637	18
43	82228	2498253	2494861	3392	996613	17
44	82518	2494734	2491318	3416	996589	16
45	82808	2491227	2487787	3440	996565	15
46	83098	2487733	2484268	3465	996541	14
47	83388	2484250	2480761	3489	996517	13
48	83678	2480780	2477267	3513	996493	12
49	83968	2477322	2473784	3537	996468	11
50	84257	2473866	2470314	3562	996444	10
51	84547	2470442	2466855	3587	996419	9
52	84837	2467020	2463408	3612	996395	8
53	85127	2463609	2459973	3636	996370	7
54	85417	2460210	2456549	3661	996345	6
55	85707	2456823	2453136	3686	996320	5
56	85996	2453447	2449736	3711	996295	4
57	86286	2450083	2446346	3737	996270	3
58	86576	2446730	2442968	3762	996245	2
59	86866	2443388	2439601	3787	996220	1
60	87156	2440058	2436245	3813	996195	0

Min.

Deg. 5

m	Sines.	Logarith.	Differen.	Logarit.	Sines.
0	87156	2440058	2436245	3813	99619560
1	87445	2436738	2432900	3838	99616959
2	87735	2433430	2429566	3864	99614458
3	88025	2430133	2426243	3889	99611857
4	88315	2426847	2422932	3915	99609356
5	88604	2423571	2419630	3941	99606755
6	88894	2420306	2416340	3967	99604154
7	89184	2417052	2413059	3993	99601553
8	89474	2413809	2409790	4019	99598952
9	89763	2410576	2406531	4045	99596351
10	90053	2407354	2403282	4071	99593750
11	90343	2404142	2400045	4098	99591149
12	90632	2400941	2396817	4124	99588448
13	90922	2397749	2393599	4150	99585847
14	91212	2394568	2390391	4177	99583146
15	91502	2391398	2387194	4204	99580545
16	91791	2388237	2384007	4230	99577844
17	92081	2385087	2380829	4257	99575143
18	92371	2381946	2377661	4284	99572442
19	92660	2378815	2374504	4311	99569841
20	92950	2375694	2371356	4339	99567240
21	93239	2372583	2368217	4365	99564639
22	93529	2369482	2365089	4393	99562038
23	93819	2366390	2361965	4420	99559437
24	94108	2363308	2358860	4448	99556836
25	94398	2360235	2355760	4475	99554235
26	94687	2357172	2352669	4503	99551634
27	94977	2354119	2349588	4531	99549033
28	95267	2351075	2346516	4558	99546432
29	95556	2348040	2343453	4586	99543831
30	95846	2345014	2340400	4614	99541230

Min.

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Deg. 5

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	m	Sines	Logarith.	Differen.	Logarit.	Sines	
560	30	95846	2345014	2340400	4614	995396	30
5959	31	96135	2341998	2337356	4642	995368	29
458	32	96425	2338991	2334320	4670	995340	28
857	33	96714	2335993	2331294	4699	995312	27
9356	34	97004	2333004	2328277	4727	995284	26
5755	35	97293	2330023	2325268	4755	995256	25
4154	36	97583	2327052	2322269	4784	995227	24
553	37	97872	2324090	2319278	4812	995199	23
8952	38	98162	2321137	2316296	4841	995170	22
6351	39	98451	2318192	2313322	4870	995142	21
3750	40	98741	2315256	2310357	4899	995113	20
1049	4	99030	2312220	2307401	4928	995084	19
3448	42	99320	2309410	2304453	4957	995056	18
5847	43	99609	2306500	2301514	4986	995027	17
3146	44	99899	2303598	2298584	5015	994998	16
0545	45	100188	2300706	2295661	5044	994968	15
7844	46	100477	2297821	2292748	5073	994939	14
5143	47	100767	2294945	2289842	5103	994910	13
2442	48	101056	2292077	2286945	5132	994881	12
9841	49	101346	2289217	2284055	5162	994851	11
7040	50	101635	2286366	2281171	5192	994822	10
4439	51	101924	2283523	2278301	5221	994792	9
1638	52	102214	2280688	2275437	5251	994762	8
8937	53	102503	2277861	2272580	5281	994733	7
6236	54	102793	2275042	2269731	5311	994703	6
3535	55	103082	2272231	2266890	5341	994673	5
0734	56	103371	3269428	2264057	5371	994643	4
7933	57	103661	2266633	2261232	5402	994613	3
5232	58	103950	2263846	2258414	5432	994583	2
2431	59	104239	2261066	2255604	5463	994552	1
9630	60	104528	2258295	2252802	5493	994522	0
Min.						Min.	

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Deg. 6

+1-

m.	Sines	Logarith.	Differen.	Logarit.	Sines
0	104528	2258295	2252802	5493	99452260
1	104818	2255531	2250007	5524	99449159
2	105107	2252775	2247221	5554	99446158
3	105396	2250027	2244441	5585	99443057
4	105686	2247286	2241670	5616	99440056
5	105975	2244553	2238905	5647	99436955
6	106264	2241827	2236149	5678	99433854
7	106553	2239109	2233400	5709	99430743
8	106843	2236398	2230658	5740	99427652
9	107132	2233695	2227923	5772	99424551
10	107421	2230999	2225196	5803	99421450
11	107710	2228310	2222476	5835	99418249
12	107999	2225629	2219763	5866	99415148
13	108289	2222954	2217057	5898	99411947
14	108578	2220288	2214358	5930	99408846
15	108867	2217628	2211667	5961	99405645
16	109156	2214976	2208983	5993	99402544
17	109445	2212331	2206305	6025	99399343
18	109734	2209692	2203635	6057	99396142
19	110023	2207061	2200972	6089	99392941
20	110313	2204437	2198315	6122	99389740
21	110602	2201819	2195665	6154	99386539
22	110891	2199209	2193023	6186	99383338
23	111180	2196605	2190386	6219	99380037
24	111469	2194009	2187757	6251	99376836
25	111758	2191419	2185134	6284	99373535
26	112047	2188835	2182518	6317	99370334
27	112336	2186259	2179909	6350	99367033
28	112625	2183689	2177306	6383	99363832
29	112914	2181126	2174710	6416	99360531
30	113203	2178570	2172121	6449	99357230

Min.

Deg. 83

Deg. 6

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m.	Sines	Logarith.	Differen.	Logarit.	Sines	Min.
60	30 113203	2178570	2172121	6449	993572	30
59	31 113492	2176020	2169538	6482	993539	29
58	32 113781	2173477	2166961	6515	993506	28
57	33 114070	2170940	2164392	6549	993473	27
56	34 114359	2168410	2161828	6582	993439	26
55	35 114648	2165886	2159270	6616	993406	25
54	36 114937	2163369	2156720	6649	993373	24
43	37 115226	2160859	2154176	6683	993339	23
52	38 115515	2158354	2151637	6717	993306	22
51	39 115804	2155856	2149105	6751	993272	21
50	40 116093	2153364	2146579	6785	993238	20
49	41 116382	2150878	2144059	6819	993205	19
48	42 116671	2148399	2141546	6853	993171	18
47	43 116960	2145925	2139038	6887	993137	17
46	44 117248	2143458	2136537	6921	993103	16
45	45 117537	2140998	2134042	6956	993068	15
44	46 117826	2138543	2131553	6990	993034	14
43	47 118115	2136095	2129070	7025	993000	13
42	48 118404	2133652	2126593	7059	992966	12
41	49 118693	2131216	2124122	7094	992931	11
40	50 118982	2128785	2121657	7129	992896	10
39	51 119270	2126361	2119197	7164	992862	9
38	52 119559	2123942	2116744	7199	992827	8
37	53 119848	2121530	2114296	7234	992792	7
36	54 120137	2119123	2111854	7269	992757	6
35	55 120425	2116722	2109418	7304	992722	5
34	56 120714	2114327	2106988	7340	992687	4
33	57 121003	2111938	2104563	7375	992652	3
32	58 121292	2109555	2102144	7410	992617	2
31	59 121580	2107177	2099731	7446	992582	1
30	60 121869	2104805	2097323	7482	992546	0

Min.

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